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POPULAR SCIENCE

Nov. 35¢ MONTHLY

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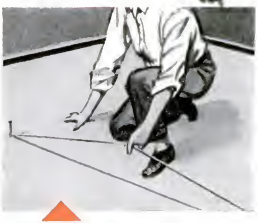

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ARE THESE MISTAKES HOLDING YOU BACK?

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YES NO

☐ ☐ **Do you put things off?** To get anywhere you have to make a start.

☐ ☐ **Do you really want to succeed?** Isn't there something you want enough to work for it? Marriage, a new home, money for your family—all depend on your advancement.

☐ ☐ **Are you unwilling to give up temporary pleasures?** Some people think more of a good time now than of promotion and higher pay later on.

☐ ☐ **Are you too lazy to plan ahead?** You've got to manage your life, plan for success and stick to it.

☐ ☐ **Are you afraid of responsibility?** In a bigger job you'll have to make decisions, act, be somebody.

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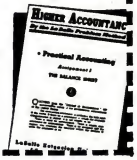

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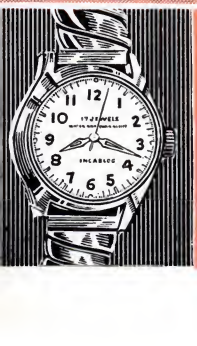

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Letters

Teen-Age Road-e-o Winners

The thanks of the Jaycees and Teen-Age Road-e-o sponsors are due POPULAR SCIENCE MONTHLY for publishing that very fine article, "How They Pick America's Best Young Driver," in your August issue [p. 80].

Here is a picture of the five top winners.

In the front row, left to right, are Ronald Hendricks, Belton, S. C., second; Clement C. Wagner, Kansas City, Mo., first; Clay Gervais, Carmichael, Calif., third. In the back row, left to right, are Alan R. Foster, Auburn, N. Y., fourth; and J. Robert Austin, Burlington, Vt., fifth.

MIKE CUSACK,
National Teen-Age Road-e-o,
Tulsa, Okla.

Retractable Island Was Sunk

I seem to remember that the giant aircraft carrier *Forrestal* was supposed to have a retractable control island. Did Mr. Comstock overlook it in his report on the "Biggest Ship Ever Built" [Aug., p. 128]?

KENNETH ROZETT, Brooklyn

Your memory is good, but the Navy changed its mind. Its experience with the canted-deck carrier Antietam *led it to eliminate the retractable-island feature intend-*

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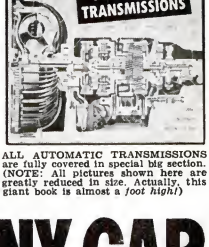

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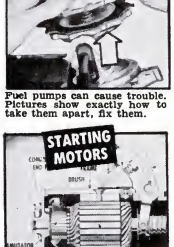
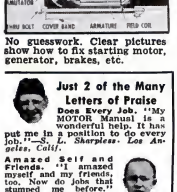


Fuel pumps can cause trouble. Pictures show exactly how to take them apart, fix them.



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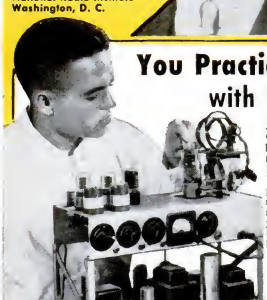

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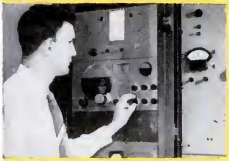

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Assistant Operator

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Airways Operator
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AVIATION RADIO
Transmitter Technician
Airport Transmitter Operator

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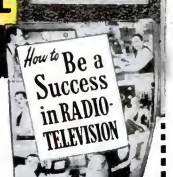

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ed for the Forrestal. *This move cut $5,000,000 off the cost of the carrier and caused Navy engineers to sigh with relief.*

Sting Rays Don't Like Crowds

You had a very interesting article, as usual, on the ugly sting ray [July, p. 117]. I was especially interested since we plan to go to Atlantic City for our next vacation.

What are our chances of running into sting rays there?

MRS. PAUL HOOD, Columbus, Ohio

Sting rays like relatively quiet water and unpopulated areas. Since there are almost always bathers in the water at Atlantic City, the rays—if there should be any at all—would be inclined to move away. Besides, they prefer the warmer waters along the southern coast.

Slow But Hard to Beat

The LST's main trouble was that it was not speedy or maneuverable enough, but an airplane is not a feasible substitute for it, even the kind that you pictured in your August issue [p. 86].

In the sustained ground fire that the LSTs took, an airplane would be a pile of junk in seconds. With its propellers splintered, nobody could move it, and with its rudder and ailerons shot up, it couldn't be steered.

Let ships stick to the sea and planes to the air.

LIEUT. J. J. STEVENSON, Cincinnati

Hot Under the Collar

To mention Sebring in the same breath as Le Mans, as Frank Rowsome did in "What Is a Sports Car?" [May, p. 98], enrages me. I would take leave to inform him that Le Mans has been catering to international races more years than he has fingers and toes, while Sebring hasn't had enough rubber burned on it to distinguish it from a farm track in your Ozarks.

My criticism is not directed at POPULAR SCIENCE MONTHLY, which we Cowdens

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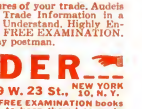

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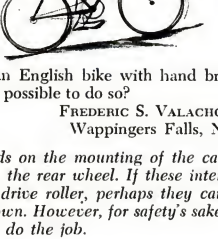
think is the best of its type anywhere; but some of your contributors seem to think the world stops at the Atlantic seaboard.

C. Cowden, Darlington, England

A Bike Problem

I'd like to motorize my bicycle, as described in your August issue [p. 147]. But



mine is an English bike with hand brakes only. Is it possible to do so?

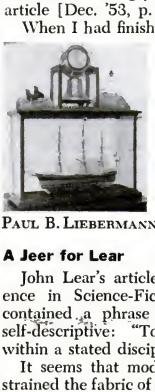
Frederic S. Valachovic, Wappingers Falls, N. Y.

Depends on the mounting of the caliper brakes on the rear wheel. If these interfere with the drive roller, perhaps they can be moved down. However, for safety's sake, let an expert do the job.

Nautical and Nice, Too

I built a model of the *Sovereign of the Seas* after reading your exceedingly helpful article [Dec. '53, p. 202] on how to do it.

When I had finished the model, I housed it in a substantial showcase to protect it from injury.



Since that time I have added a ship's clock, a flashing lighthouse and some nautical figurines to the display, as you can see in the photo.

Paul B. Liebermann, San Bernardino, Calif.

A Jeer for Lear

John Lear's article "Let's Put Some Science in Science-Fiction" [Aug., p. 135] contained a phrase which is significantly self-descriptive: "To think imaginatively within a stated discipline."

It seems that modern science-fiction has strained the fabric of Mr. Lear's imagination, which, like aged rubber, has grown brittle and inflexible.

All through his article he calls for science-fiction which describes the immediate

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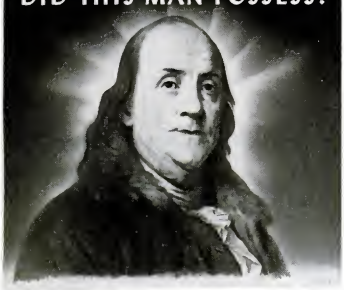

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future. This is his "stated discipline." This is the limit, in all four dimensions, of his imagination. This is why he wishes to transform science-fiction into a glorified science reporting for school children and praises only predictions which have come true.

As Goethe once advised: "Before you reproach an author for obscurity, examine your own mind. Twilight makes even plain writing illegible."

BRIAN SKYRMS, Pittsburgh, Pa.

A Cheer for Lear

When I was a child I read stories
Of Andersen's fairies and Grimm's,
But when I matured a little
I put away such childish whims.

I still read some fairy stories,
But I like ones that could be true,
So let's put the accent on science
And skip all the hullabaloo.

I studied science in high school,
I know my genes from my germs,
So please don't offend this kind reader
With tales about orange, talking worms.

Tell me of intelligent men
Who dare to probe nature's mystery,
Since you agree with me, John Lear,
May your name go down in history.

Congratulations to you, sir,
May others avail of your tips,
On preparing our minds for space,
As others prepare the ships.

ELISABETH R. DYER, Old Orchard, Maine

Reads PSM for Over Half a Century

Harry T. Knox of Rock Island, Ill., has been reading POPULAR SCIENCE MONTHLY for 56 years. That adds up to a lot of magazines (672, in fact).

Knox, 64 years old and a craftsman since his boyhood, remembers that he charged his first workbench with electricity to keep unwelcome visitors away.

"It's the pictures and color I like in the magazine these days," he says. "That's a big change from 1898, when my father gave me my first subscription." Knox also likes New Ideas from the Inventors. He's dreamed up quite a few gadgets himself.

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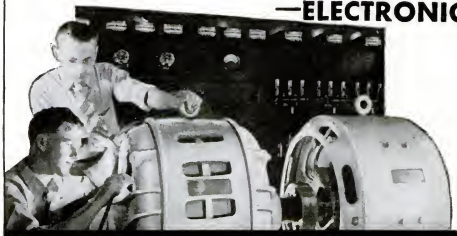

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(Right—Instructor helping students check the wiring and trace circuits of television receivers.)

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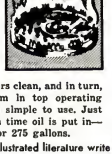

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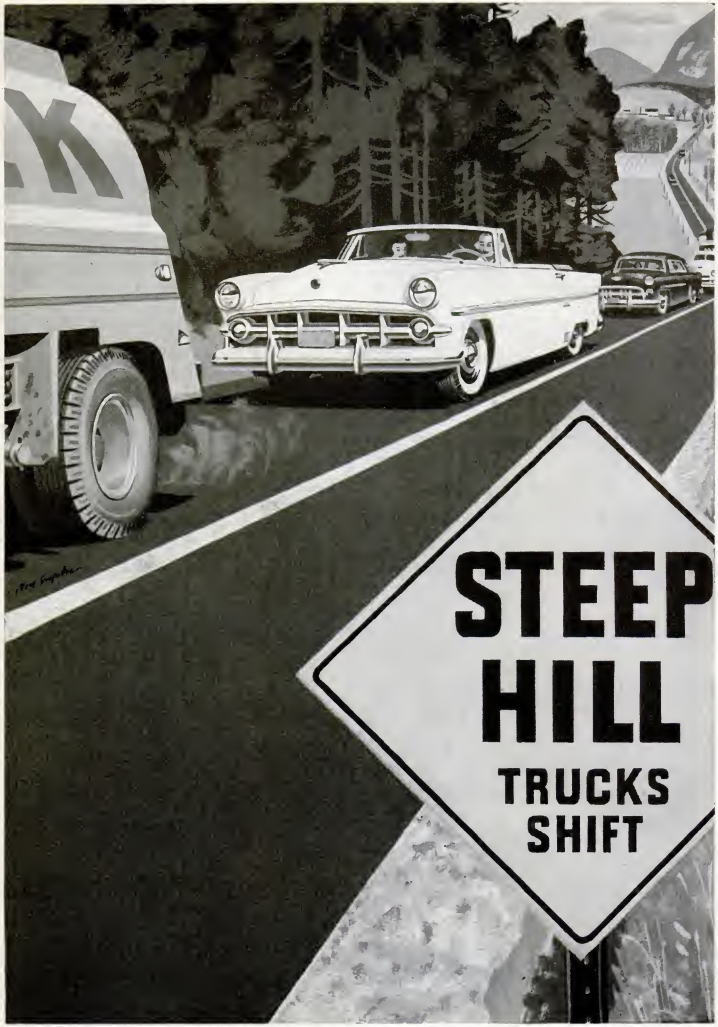
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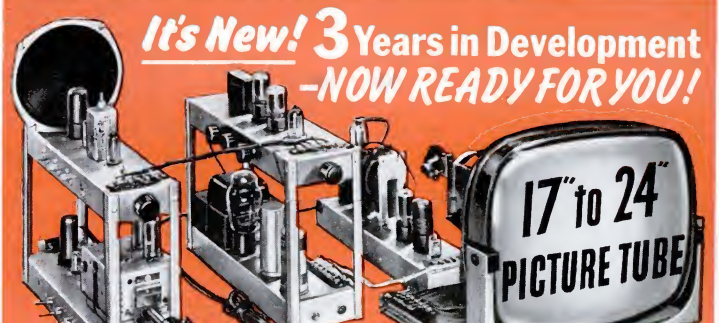

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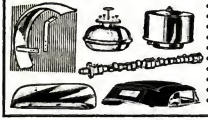

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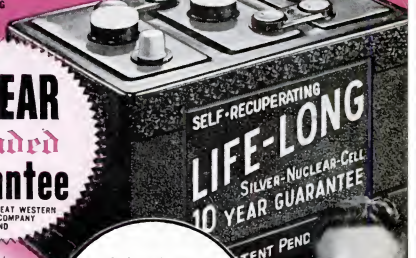

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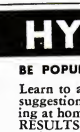

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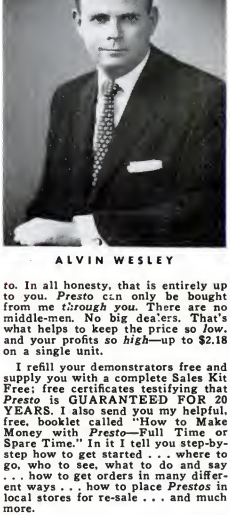

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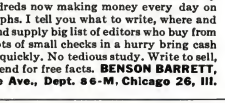

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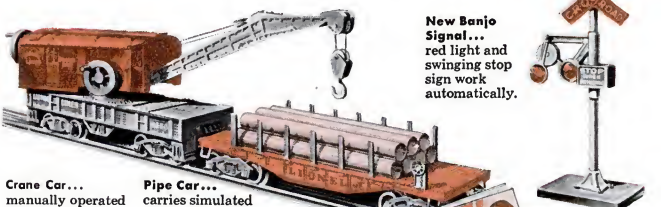

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650x16(6)	7.05	710x15	5.25	750x17	10.55	825x20	17.55
700x16	6.15	760x15	5.75	750x15	10.45	900x20	17.65
750x16(6)	8.35	800x15	6.05	825x15	10.45	1000x20	16.55
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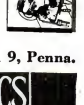

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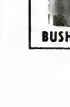

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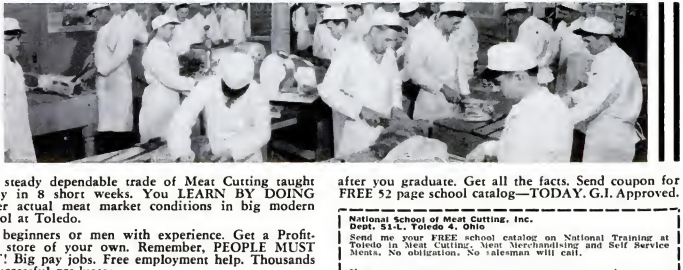

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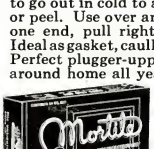

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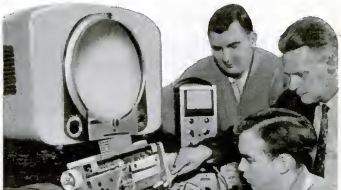

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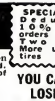

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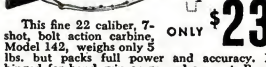

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This year simplify your Christmas shopping and make sure you get the gifts you want.

Check the following pages of the Christmas Gift Mart carefully for gift ideas. Jot down those you want for YOURSELF. And since there are suggestions for everyone, list the presents for the whole family on the handy Memo on this page. If you're in doubt, let the others in the family browse through the Gift Mart and jot down the gifts THEY want themselves.

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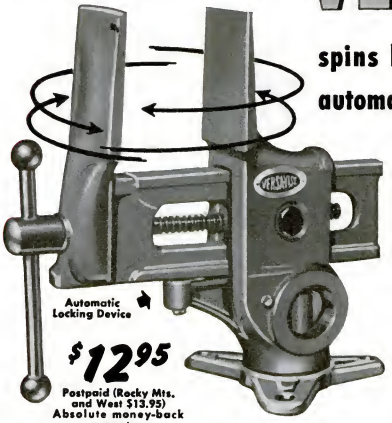
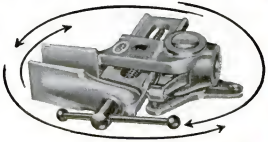


spins horizontally or vertically... automatically locks in any position



When placed on base in horizontal position, it lies flat on either side for right or left hand use—turns to most convenient work position.

$12.95

Postpaid (Rocky Mts. and West $13.95)
Absolute money-back guarantee.

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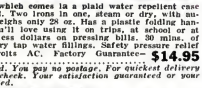

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Complete Telescope Lens Kit *only* **$3.49** postpaid

Conquer Space, Explore the Universe, Planets, Moon Craters, New Stars, etc. Complete Lens Kit consists of 80 inch focal length ground and polished objective lens, eyepiece lenses for 50 POWER, 100 POWER, 150 POWER, 200 POWER, 250 POWER, and all necessary lens fittings. Easy to make from simple step by step instructions. (Tripod and mount not included.) Money back guarantee.

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French STYLE DUELING SWORDS

SET OF TWO **$3.98** pre paid

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A private phone or Intercom system. Easy to operate. Ideal for use on farms, target range, mountains or forest or any place portable two-way communication is desired. Gives clear reception up to 15 miles. Uses two standard batteries. Set contains ringing generator, leather carrying case and one phone. Several of these phones may be used on one line. Reconditioned and checked out. Price per each phone - only **14.95**

Price for a system - two sets... **29.50**

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LIFTS 1500 POUNDS Made for U.S.Navy Bureau of Ordnance as a Bomb Hoist. Has a 21 to 1 gear ratio. 40" tubular arm extension with a 3" pulley on the end. Drum has 12 in. of 3/16" high tensile strength steel cable. The operating handle has a ratchet brake ideal for 'swing about', truck or platform loadings. A $125.00 Surplus Value. **27.50**

2500 lb LIFT HOIST

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29.50 WITHOUT MOUNT

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Has 12" steel head with mattock one side and pick on other. With belt case & hardwood handle. **1.39**

POCKET SHOVEL NEW

G.I. Surplus. 28" hardwood handle. Blade folds to form pick. Carry in car for emergency in mud or snow. Ideal for camper, etc. **1.29**

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3ft. x 6ft. x 3mm approx. 1/8" 18 sq. ft. **1.79** FULL SHEET $5.00 VALUE Min. Order - 8 Sheets

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$130 VALUE

A precision-built Drafting Machine for draftsmen, Engineers, Artists, Navigators, etc. This fine machine has been precision converted from an Air Corps Navigational Plotting & Drafting Machine. It has a 90° chuck for use with all Standard drafting machine scales. Sturdy 18" arms rotate on double-sealed lifetime ball bearings. Graduations on the vernier hub are from 0 to 360° in 1° increments. Locks in any desired position. Bands are of K-Monel metal. Compares to instruments costing to $130. **49.95**

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A bargain for the student, draftsman, architect, etc. Has a 4-1/2" divider, a 4-1/2" compass with pen & pencil parts, a 3-1/2" reverse bow compass for pencil and ink, a 4-1/2" ruling pen, capsule of extra leads. All in a velvet lined case.

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Guaranteed

An ideal gift for the artist or draftsman. Permits drawing perfect ellipses every time. Has projections of 20, 30, 45 and 60 degrees. Ellipses will range from 3/8" to 2-3/4" on a major axis. Kit size 4-3/4" x 9-3/4" x ½". **7.50**

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Combines in one template means for measuring sizes and shapes of of nuts bolts, rivets, etc. . . . **1.35**

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ORDER NOW!

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For Botanist, Mineralogist, Prospector, Rockhound, etc. Specially made for and imported by us. Has precision ground and polished lenses. Moisture proof. Magnification 30, 45 & 60 power. **3.75**

AMAZING NEW MICROSCOPE TELESCOPE

A new optical development. A pocket size Microscope-Telescope. When closed it serves as a 50 POWER Microscope, when opened out it serves as a full 10 POWER Telescope. Only inexpensive Japanese labor can make this price possible. . . **4.39**

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Has fine ground lenses of optical glass. Neutralizes eye strain from close work. Twin lens, binocular design gives third dimension vision. Allows freedom of both hands. Can be worn over glasses. Ideal for jewelers, watchmakers, artist, etc.

MAGNI-FOCUSER SIZES

focal length	power	price each
20"	1½ x	
14"	1½ x	
10"	2½ x	**10.50**
8"	2½ x	

ARMY MACHETTE

Has 18", Vanadium steel blade. Hardwood handle. Belt sheath. 23" overall. A campers friend. **1.98**

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Makes Surf or Deep Stream Fishing a real pleasure. Also ideal for use wherever it is necessary to protect the body or clothes from mud, silt, moisture, etc. Made to top Government specifications. Originally designed for use as an overall suit in landing operations. Of heavy duty rubberized canvas with vulcanized seams. Has built-in rubber boots and gloves. Sizes: Medium and large. 35.00 VALUE NEW **9.95**

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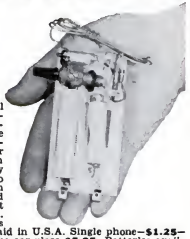

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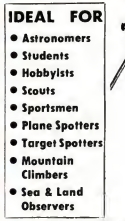

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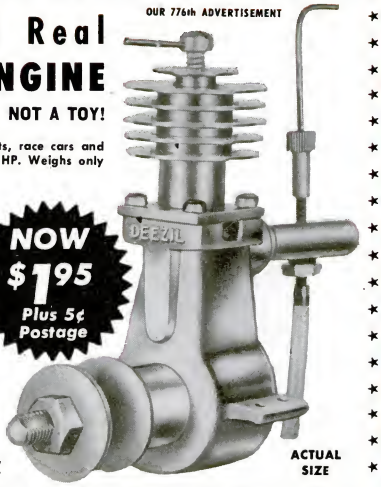

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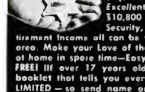

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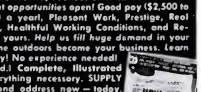

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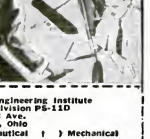

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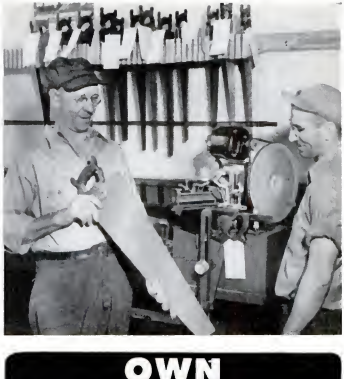

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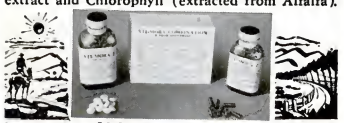

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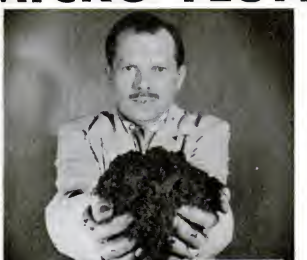

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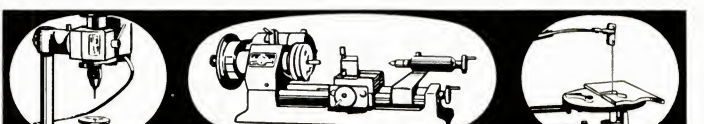

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SONGS Or Song Poems Needed for Commercial Recording. Quick action. Celebrated expert offers you Free Copy of "Secrets of Song Success." Honest deal designed to benefit all concerned. Mail songs or poems now. Rexright Music Co., Dept. B, 5617 Hollywood Blvd., Hollywood 28, Calif.

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MAKE Simple, Tubeless, Batteryless, Distance-Getting radio. Genuine Melomite crystal. Detector. Illustrated instructions. 50c postpaid. Allen, 427-PS5, Clinton, Mo.

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OPERATE profitable mail order business. Write Walter Service, 4159-B East 112th, Cleveland 5, Ohio.

MEN Wanted—Build Luggage And Cases At Home. We sell your products—supply complete instructions, materials, everything. No special equipment needed. Free details. Casecraft 805-H11 Sunset, Los Angeles 12, Calif.

$25 WEEKLY working two hours daily at home. Lycke, Box 2471-B, Cleveland 12, Ohio.

SEND out postcards. Cash daily. Bicorp, 143 Belmont, Belmont, Mass.

BRONZE Baby Shoes. Instructions, Equipment and mountings for genuine electroplated process. Free catalog. Hollywood Bronze Supply, Dept. B-1, 1624 East First Street, Los Angeles 33, California.

BOOKKEEPERS, increase earnings operating sensational bookkeeping service. Kern, 5632 Lankershim, No. Hollywood, Calif.

MINK Raising information free. Complete. Lake Superior Mink Farm, Superior E E5, Wisconsin.

MONEY for your spare time. Agents needed for leading national magazines. Liberal commissions. Write ATSA, 3132 M St., N.W., Washington 7, D.C.

SELL name brands—no inventory. Manhattan-F, 225 West 57 Street, New York City.

POPCORN and Potato Chip Equipment. Eakins, Box 933-B, Springfield, Ohio.

LIQUID Rubber makes flexible molds. Free Sample. Chaney, 1130 E. 16th St., Jacksonville 6, Fla.

INCREASED income repairing with Cup-L Rivets. One man installation. Fast, Easy, Clean. 2500 uses applicable to all fields. Nothing equals. Literature, sample, $1.00. Cup-L, 31486 West, South Laguna, California.

MAKE $100.00 weekly mailing merchandise catalogs, bearing your name. Sample catalog, details 25c. Products, 2342 Washington, Chicago 12, Illinois.

YOUR envelopes addressed accurately, reasonably. Fast service. We have capable addressers in your city. Glenway System, 5713 Euclid, Cleveland 3, Ohio.

MAKE Money At Home as renewal headquarters for all magazines. Big Christmas sales profits now. Liberal commissions. Supplies furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510B, Mount Morris, Illinois.

WE pay $5.00 for some names. Homework income plan 25c coin. Pacific, Box 73136, Los Angeles 3.

WHOLESALE! 8.000 Nationally Famous Products. 30-80% Discounts! Large Catalog. Sensational Business Plans Included. Consolidated Distributors, 21-15 Lafayette, Paterson 15, New Jersey.

$500.00 COMMISSION Monthly from one order per day. No Investment. No Inventory. Richmond Enterprises, Box 1003, Augusta, Georgia.

BUY wholesale direct! Save yourself 66-2/3% on 10.000 nationally advertised Appliances, Sporting Goods, Watches, Furniture, Auto Parts, Toys, Giftwares. Sell at tremendous savings to individuals, organizations. Amazing profits! Free "Wholesale Idea". National Buyers Service, Box 426FA, Oakland, California.

FREE New 280-Page Book: 2000 businesses, farms, income properties for sale thruout America. Specify type of business desired, and general location. Book No. 77, 5400 Wilshire, Los Angeles, California.

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START venetian blind laundry, patented machine. Free information. LC Company, 522 N. Rural, Indianapolis 1, Indiana.

WELDERS make ornamental iron railings instructions $1.00. Joseph O'Connor, Milan, Ohio.

TELEVISION repair business, $39.50 total cost. Amazing one-day training, no studying. Proven technique. Make $15 to $20 day immediately! No experience needed. Investigate! Free home business plan. Write LS Engineering, Box 4113, Dept. PS-11, North Hollywood, California.

NOTARY public information free. Magnolia Press, Box 1272-S, Burbank, Calif.

ADDRESS advertising postcards. Extra Cash Daily, Box 5022, Tampa 5, Florida.

TO $40.00 weekly. Sparetime, home operated mailorder business. Successful "Beginner's" plan. Everything supplied. Lynn, 10420-C National, Los Angeles 34, Calif.

THRILLING Profitable Home Business. Make fast-seller chenille monkey trees, dolls, flowers. Terrific holiday demand. Information free. Velva, Bohemia 17, N. Y.

MAIL Order business information Booklet, Opportunities, Offers, Sample Magazine, Big Mail 25c. Harvey Teeple, (PS2), Decatur, Indiana.

BIG profits owning your own wholesale merchandising business. No investment! America's greatest wholesale Appliances, Homewares, Jewelry, Sporting Goods catalog in color with your own name. We drop ship. Free Catalog. General Wholesalers, Box 1195FG, Chicago; Box 3058FG, San Francisco.

REPAIR Dolls; make rubber stamps. Catalog "60 Ideas" Free. Universal, Box 1076-B, Peoria, Illinois.

MAIL Order! Details free. Lexington Mail Service, 5511-B Monroe, Chicago 44.

EARN extra money weekly mailing circulars for advertisers. Complete instructions —25c. Siwasilan, 4317-B Gleane, Elmhurst 73, New York.

NATURAL molding rubber, extra thick. Free sample. Flock. W. Wooley, 115-B Donald, Peoria, Illinois.

EARN $15.000-$30.000 Annually. Franchise protected. Guaranteed minimum $12.500 or money back. Live at home. No merchandise to buy. Self-employed. One of the most exclusive and noncompetitive businesses in United States and Canada. Send for free explanatory booklet. Harrell & Company, Box A-2, Louisville, Illinois.

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GROW Mushrooms. Cellar, shed, and outdoors. Spare, full time, year round. We pay $3.50 lb. We paid Babbitt $4.165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 178, 2954 Admiral Way, Seattle, Washington.

OPERATE profitable mail order business selling our cartooning courses. Templeton, 1210-D Riverview Terrace, Columbus 1, Ohio.

WANTED! Home Producers, by manufacturers in our Clearing House Service. Become subcontractor, casting plastic products for these companies. Thousands of easy-to-make items required for consumer-industrial use. Cash in at home, without previous experience. Plastic Service Associates, Dept. 11-PS, East Boston 28, Massachusetts.

TRADE Magazines. See late copies through our easy to get acquainted service. Choose from 4.387, covering all fields. Current List Free. Commercial Engraving Publishing Company, 34S North Ritter, Indianapolis 19, Indiana.

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OPERATE "Escolator" Mailorder System, selling our products or any products. Write: Selbyco, Decatur 174, Illinois.

NEW—Different Home Business Opportunity! Address-Mail Literature Featuring Real Merchandise. Everything furnished. Mills, 1752-B, Garden Avenue, Lorain, Ohio.

START your own business—Selling Vitamins. Small investment—terrific profits. National Health, 83 Barclay St. N. Y. 7.

MAILORDER Business! Your own! Write: Floyd's, 515 Stag, Ville Platte, La.

FREE booklet "Money Making Facts" tells mechanically-inclined men how to start sparetime business at home. Charles Foley Company, Columbia Heights, Minn.

IT'S Here! 1200% profit! Now, plastic seal photos, cards, licenses, etc. for lifetime protection. No equipment needed. Takes just seconds. Everybody your prospect. Also, sell Laminating kits or/and supply other "homeworkers" everywhere. Complete laminating kit $1, postpaid (seals 10 articles). Wholesale prices, all details. "Satisfaction guaranteed". Garen Sales, 1321-F4 Stanberry Ave., Zanesville, Ohio.

BE President of your own manufacturing or selling corporation! If you have a sound idea for a product or service, and need money or manpower, perhaps we can help. Send self-addressed, stamped envelope and 50c for brief outline of our offer. P. S. Bromley, c/o Wilbourne & Bromley, Engineering Building, Chicago 6, Illinois.

WHOLESALE Buy Early large Xmas catalog 50c nationally advertised appliances, jewelry, watches, etc. Terrific reductions. International Sales Co., 175-B Fifth Ave., New York 10.

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GET Dollars In Your Mail—Keep Every Cent. Genmerco, Box 142-B, Dorchester 24. Mass.

NEW Exceptionally Profitable plans. Ideas for home operated mail business. Rush name. Miller, 1881-R Roxbury Road, East Cleveland 12, Ohio.

STAY Home—Sell Merchandise By Mail! Everything furnished. Orders filled. Big earnings. National, Box 88-B, Dorchester 22 Mass.

PROFITABLE mail-order Import business. Send $1.00 for imported gift worth $2.00 and free details. Transamerican, Box 815-B. Atlanta 1, Georgia.

SAVE money—buy from importer. Free information. P. Fleming-Importer. Dept. PS11. 303 Fifth Avenue, New York City 16.

MOTEL & Resort Managers Needed. Approximately 5000 new Motels built each year. This expanding Motel Business sorely needs competent and trained Managers. Ideally suited to couples, 30 to 60. Good pay and secure future. Send $1 for complete information on Motel Home Training. Mr. L. I. Heater, International Motels, Inc., Dept. PS, Millbrae, Calif.

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GET Money by mail. Succeedco, P. O. Box 962, Portland 7, Oregon.

HAVE Home Mail Business—Get $10 Orders in Every Mail—Keep $8.00. Everything furnished. Hutchinson, Box 87-C, Dorchester 22. Mass.

MAKE Perfumes Other Profitable Products, Home. "Carelabs", 1914 Choteau-PS10. St. Louis 3, Missouri.

ELECTROPLATE autoparts, novelties, mirrors, baby shoes. Easy, inexpensive home processes. Free booklet. Tyco Metals, Box 13231-CQ. Houston 19, Texas.

MONTHLY repeat business which you can operate in your own community. For free details write Grasak, 321—28th Street, McKeesport, Pennsylvania.

FRANCHISES make amazing profits! Exclusive distributorships, dealerships, agencies available. Fascinating, nationwide opportunities. Information rushed. National Franchise Reports, R-810, 920 North Michigan Avenue, Chicago 11, Ill.

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MAKE flexible molds. Cast plaques, figurines. Free sample. Tooker, 630-A Chestnut, Hamilton, Ohio.

GET $10.00 Orders by Mail! 100% profit! Everything furnished. Terrell, Bogard, Missouri.

"MAKE Perfumes," other products—Sell mailorder—Formula Catalogue Free. "International," 6347 Parnell-PS-11, Chicago 21. Illinois.

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START Venetian Blind Laundry. Profitable lifetime business. New machine. Free booklet. F.D. Co., 442 N. Seneca, Wichita 12, Kansas.

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$46 FROM Square Foot Plywood; Jigsaw necessary. Write: Woodart, Bridgewater, Massachusetts.

UNUSUAL homework opportunity. Spinning angora for us. Men, women, spare-time. Angora House, PSM, Springfield, Ill.

COLORGLAZED Concrete pottery made without molds. Patented method. Cemetery products, novelties, tiles. Basement leak-sealing. Money-making projects. Booklet, details free. Men only. National Potteries. Grand Rapids "Minnesota."

WANTED qualified men to be our factory agents. Unlimited opportunities, prestige, independence, financial success. Start introducing the famous wattage regulators. Make spare time worth $1000.00 monthly. When dealer qualified make $1000.00 weekly and up. Details on request. Don't delay. Territories limited. Scientific Electric Co., Box 2162-BD, Cleveland 8. O.

RAISE Earthworms! Terrific! Essential information plus story, "An Earthworm Turned His Life." Send dime. Earthmaster System, 14H, El Monte, Calif. Hurry!

JUST like having an oil wel'—have money flowing in for years. Operate new profitable home business. No direct selling, no telephone canvassing, no appointments to keep. Practically works itself. Everything supplied. Can be started even on a budget. Write Dar-Craft, Box 268, Monroe, Washington.

"BRONZED" Baby Shoe .Mountings, Supplies, Instructions. Fosters, 1520 Ardmore, Chicago.

RESTORE your vision completely. All ages. Inexpensive. Free information. Lil-Co., 1109 W. 11, Pine Bluff, Arkansas.

I Average $125 weekly selling books by mail! So can you! Start sparetime! Work home! Cooper, 247 Taunton, Buffalo, N. Y.

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AVERAGE $10 an hour. Imported decorating machine simulates wallpaper. Free details and illustrations. Patternroller, 526 Beach 66th Street, Arverne 92, N. Y.

LARGE profits. No capital needed. Send $1.00 for plan and catalog of nationally advertised appliances and gifts. Stanley Brothers, 210 Linden Ave., Ithaca, N. Y.

$100 weekly mail order business. Proof submitted with instructions, $1.00. Sears, 7019 Georgia Avenue, Washington 12. D.C.

WANTED: Mechanic to represent world's finest sewing machine. Can you sell yourself? Is your wife willing to help? Want to be your own boss? Very few dollars needed to set yourself up in a going business. We'll back right man. See 3-page advertisement in September 27 Life as example of the advertising support you'll get. In East write: Pfaff American Sales Corp., Dept. PS, 373 Fifth Avenue, New York 16, New York. In West write: A. C. Weber & Co., Inc., Dept. PS, 216 North Canal Street, Chicago 6, Illinois.

MONEY Typing—Sewing! Details free. Edwards, 3915-PS, 12th, Des Moines 13, Iowa.

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GROW rare species & herbs for profit! Window sill alone may yield $100's worth. New spare-time home-profitunity! Easy! Fascinating! We supply everything! Write: National Herb Exchange, Box 304-P, Gardena, California.

$15.00 THOUSAND Possible — highest prices compiling mailing lists and addressing from them; longhand, typewriter. Particulars free. Economy Publishers, Rowley, Mass.

$250 WEEKLY! Depressionproof, Renovating Business. Puraclean, 17-C East 42nd, New York 17.

OWN. Operate, Route—"Wishing Wells." Place these New $8.50 Skill Games on counters in Cafes, Clubs, Luncheonettes, etc., collect coins weekly. Write "Legaisheres." Box 929, Long Beach 1, Calif.

BUY Wholesale thousands items. Lists Free. Cottage Industries, Omaha 12, Neb.

EARN $2.00 Hour! I do—making Sandals. Youngs, 1308-PS South First, Arcadia. California.

50 MONEYMAKING Home Business Opportunities. 25c. Myrtle G. Showe, 152 W. Muir, Hazel Park, Michigan.

FREE Kit Puts You In Business Selling World's Famous French Type Perfumes. Sensationally Low Priced! Highest Profits. Profit Packed Christmas Sales. "Husk" O'Hare. 5732 North Kenmore, Chicago 40, Illinois.

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10,000% Profit! Details Free! Star Industries, 366 Eden, Glen Lake, Minnesota.

BUY it wholesale. Manufacturers. Distributors. Over 850,000 items. Literature free. Olsen, 1231-B East Third St., Duluth 5, Minnesota.

$1.00 MAILORDER Item. Light Mailer. Prospects. Every Home. Circulars Furnished Free. Gordon Products, Box 1022A, Syracuse 1, N. Y.

MAKE money assembling and selling beautiful Cholla cactus Covered Wagon lamps. Gorgeous shades. Complete kit $4.49. Sunland Products, Box 921, Tucson, Arizona.

CLAIM INVESTIGATORS

INVESTIGATE Accidents—Earn $750 to $1000 month. Thousands of insurance companies, airlines, and steamship lines urgently need Claim Investigators. We train you at home spare time. Placement counsel and help. Free book—Now! Universal Schools, Dept. B-11, Box 8202, Dallas 5, Texas.

38 MONEYMAKING OPPORTUNITIES

SPARETIME Profits Taking Subscriptions. All Magazines, Wholesale Catalog Free. Cassell Publishers, Westfield, N. J.

FREE! "301 Profitable Small Businesses!" Amazing shoestring plans! Work Home! Start Sparetime! Deumant Surveys, Kenmore 23-S, New York.

NEW 7"x11" Ultra-Blue Signs, 7c, retail 50c. Sample free! Lowry, 812 Broadway, Dept. 823, New York 3.

MAKE money addressing envelopes sparetime. Glenway, 5713 Euclid, Cleveland 3. Ohio.

WIN contest money. General Contest Bulletin gives hundreds of tips. Lists current contests and rules. Sample 25c. General Contests, 1609-A East 5th, Duluth, Minnesota.

MAKE extra Christmas Money selling subscriptions spare time. Supplies free. Desales Magazine Service, 60 East 42nd Street, New York.

SELL-buy Titania Gems. More brilliant than diamonds. $9.75 carat wholesale. Free Catalogue. Diamonite, 1404-S Mitchell, Oakland 1, California.

START A Buying Service, buy wholesale thousands nationally advertised products. Make big profits selling at sizeable discounts. Postcard brings details. American Buyers', 630-T Linden, Buffalo, N. Y.

SCHOOL Seniors — Sell Classmates America's most beautiful Graduation Name Cards. Largest selection. Highest commission. Outsells all others. Free sample kit. Printcraft, Dept. P, 1509 Maple Street, Scranton 5, Penna.

ALUMINUM Awnings. Sell yourself. Sell neighbors. Factory prices. Write All Weather. Box 10254, Tampa, Florida.

SEND out postcards. Cash daily. Bicorp, 143 Belmont, Belmont. Mass.

MAKE Money At Home as renewal headquarters for all magazines. Big Christmas sales profits now. Liberal commissions. Supplies furnished. Write for Free Catalog. McGregor Magazine Agency, Dept. 510C, Mount Morris. Illinois.

$10,800 PROFITS! Your Own Mailorder Business! No risk! "Success Plan" Free! Treasury. 709 Webster, New Rochelle PS-24, New York.

WHOLESALE! 8,000 Nationally Famous Products. 30-80% Discounts! Large Catalog. Sensational Business Plans Included. Consolidated Distributors, 21-17 Lafayette, Paterson 15, New Jersey.

FREE Folio "Startling Unlimited Vacations Plan." No merchandise. equipment. Unknown! Works itself—home! Proven successful. Haylings-PS8. Carlsbad. Calif.

SENSATIONAL—money maker. No selling. Fix pens. Rush $1 for kit of parts, instructions, etc. Penfix, Box 38, Reading, Pa.

COLLECTORS paying up to $300.00 for old phonograph records. complete listing thousands of records wanted. prices paid (25c coin). Lizmart Company, 3404 No. Figueroa, Los Angeles 65, California.

WINNING mail order plans, Details free. Mid - State, Box 214-N, Syracuse 1, New York.

START A Mailorder business. Small Capital. Details $1.00. Fred Hettick, B-1478, Bismarck. North Dakota.

AMERICAN manufactured watches 30% to 60% discount, includes postage. taxes, insurance. Free circulars. Richmond Enterprises, Box 1003, Augusta, Georgia.

EARN Ready Cash doing mailing work —No experience needed—Y. Wilson Business Service. 7372 Melrose. Los Angeles 46, California.

ADDRESS advertising postcards. Extra Cash Daily. Box 5022. Tampa 5. Florida.

FRENCH-Type Perfume Really Sells!! Free information. or. $1.00 for 1½ dram "Flacon". Elliott-Stuart 4616-B Hollywood Blvd., Hollywood 27. California.

BUY wholesale direct! Save up to 66⅔% on nationally advertised Appliances. Homewares, Watches, Cameras, Sporting Goods, Toys, Giftwares. Free Catalog. Wholesalers Mart, Box 6125FR, Houston, Texas.

BAR items and Bar gags at wholesale, resell at 40% profit. Collins Products, Dept. 2, Box 465, North Hollywood, Calif.

FREE Folder—How To Sell Books—Merchandise By Mail. Terrific Profits. Everything Supplied. Anderson, 727-C Carney. Marinette. Wisconsin.

EXTRA Money At Home. Grow Miniature Christmas and ornamental trees in pots. Write for information on our plan and Kit. Don Pedro Farms. Rte. 2. Box 1007A. Stockton. California.

EARN Money Evenings. copying and duplicating comic cartoons for advertisers. Adservice. Argyle 2, Wisconsin.

GROW Mushrooms. Cellar. shed. and outdoors. Spare. full time. year round. We pay $3.50 lb. We paid Babbitt $4,165.00 in few weeks. Free Book. Washington Mushroom Ind., Dept. 179. 2954 Admiral Way, Seattle. Washington.

ATTENTION: Typewriter owners. Make handsome profits. Write today. Groves Company. 682 Hastings 3. Nebraska.

$15 AN hour preparing tax returns. Become tax expert. State approved training program. Union Institute, 1-P, Lakewood, New Jersey.

MANUFACTURE Rhinestone and Pearl Jewelry at home. Latest creations. tremendous profits. no skill needed. Postcard brings illustrated catalog of settings. stones, etc. A. V. Cutt Co., Inc., 210-H Fifth Ave., New York 10, New York.

WATCHES! Watches! Tremendous discounts. Free particulars. Econ-O-Mart, Box 535, Morristown, New Jersey.

FREE! Complete Mailorder Business! Terrific Profits! No Investment! VitaMins. 2908-PSX Beverly Boulevard. Los Angeles 57.

TEN Words have brought others wealth, health, happiness. Whatever your aim this system can make your success—easier. quicker. Write for details. Litho Publishing Company, 1627 Belmont Avenue, Seattle, Washington.

ADDRESSING—Mailing. Excellent income. Instructions. sample (dollar value), Materials 50c deposit. Powell's, B-583, Portsmouth, Virginia.

FREE! "Do-It-Yourself" Leathercraft Catalog Write Tandy Leather, Box 397BM. Tulsa. Okla.

PROFIT! Prestige! Publish a magazine under your own name! Only $3. per month! Sample. details 3c! Filmer, 910 Marion. Pharr 17, Texas.

URANIUM Prospecting: When, Where, How. $1.00 Brings information. Freeland, 3423 Penn., Kansas City, Missouri.

EARN up to $25 weekly, addressing envelopes at home. Onega, Box 663, Muncie. Indiana.

CASH for sparetime. New plan. Details free. Transamerican, Box 815-B, Atlanta 1. Georgia.

PRINTING and office supplies wholesale. 10,000 items. Literature free. Royal, Box 368-S. Cleveland 27. Ohio.

$50.00 WEEKLY addressing and mailing postcards. Instructions 50c. Roland, Box 381. Parkland. Penna.

DETECTIVES—Work home—Travel. Experience unnecessary. Detective Particulars free. Write. Wagoner, P-125 West 86th. New York 24.

BUY Wholesale! Thousands nationally advertised items. Save—Make Money! Free Details. Durex, Box 672-PS, Chicago 90.

MAKE to $4.50 hour doing common pen lettering. National Artists, 801½-C North Marsalis. Dallas 3, Texas.

WEEKLY extra income mailing circulars for advertisers. For information write Enterprise. 2155 Sanford, Mattapan 26, Massachusetts.

FREE Book "505 Odd Successful Businesses." Work Home! Expect something Odd! Pacific-35C. Oceanside. Calif.

MONEY Making plans and manuals. Literature Free. Kaiser, 136C Gamewell, Hackensack. New Jersey.

$35 WEEKLY addressing envelopes. Instructions $1. refundable. Adservice, Spring Valley 36. New York.

GUARANTEED Homework! Immediate commissions! Everything Furnished! Hirsch, 1301-3 Hoe. New York City 59.

FUTURE Security! Learn Watch-Clock Repairing at home. Inquire. Modern Technical Supply, 55-PS West 42nd Street, New York 36.

$200 MONTHLY Possible Raising Earthworms! Backyard. Garage. Basement. Complete. Illustrated Booklet explains raising. feeding. packing. marketing. 25c postpaid! Ozark Worm Farm-V, Willow Springs. Missouri.

WANTED: 500 Home Workers!!! Particulars 25c. Steinbergen Press, 1274-B Stebbins, New York City 59.

FREE Folder! Interesting, Profitable Business! Pinco, Box 348. Roanoke 3, Va.

DO profitable mailing from your home. Information free. Fred A. Livesey, Box 8, Miami, Oklahoma.

CASH or Credit. "Name Brands" at Wholesale prices. Leopold's, Box 1113, Columbus 16, Ohio.

ADDRESS Envelopes, Postcards at Home Sparetime. $50.00 Weekly Possible Instructions—$1.00. Fisher—PS 3213 Mission, San Francisco, Calif.

"GIFTS and Gadgets" the handcrafters' own catalog of what they make, use and sell. Send 25c. Dept. PS, Home Industries Association, 1727 K Street, N.W., Washington 6. D. C.

EXCEPTIONALLY Profitable Home Mailorder Business Plans. Lewis Bartlett, Richland. Georgia.

BUY Wholesale! Christmas gifts. appliances. housewares, Illustrated Catalog 25c. Loren Specialties, 4351-BA Flournoy, Chicago 24.

39 FORMULAS, PLANS, ETC.

FORMULAS—All kinds. Latest products. Literature free. Kemico. Park Ridge 15. Ill.

FREE Formula Catalog. Anything analyzed $35.00. Western Chemical. Salem. Ore.

FORMULAS. 10,000 for $5.00. Authentic. reliable. practical. Brockway, 1145 High, Topeka 2. Kansas.

REAL Manufacturing Formulas Lists Free. Cumming. Chemist, Gordon Avenue. Syracuse 4. New York.

MODERN Formulas. Literature Free. Jack. Chemist, 5138 Gainor Road. Philadelphia 31.

MODERN formulas for today's fastest selling big-profit products. Literature free! Miller. Chemist, 1517-A, Tampa. Florida.

LATEST modern real manufacturing formulas. list free. Moon. Martville. N.Y.

ANY Formula $3.00. Catalog — Mfg. Treatise 10c. J. Belfort, 192 N. Clark. Chicago 1.

40 PLASTICS

PLASTICS home-craft course for Men and Women. Tells and shows how to make hundreds of fast selling plastics products. All plastics and materials for 23 projects included in course. No special tools needed. Course pays for itself. Write for Free booklet. Interstate Training Service, Dept. D-2-M. Portland 13, Oregon.

HIGH Profits—Jewelry. Gifts. Novelties. Free Catalog. Pilot Plastics, 67-B Fulton, New York 38.

PLEXIGLAS. Lucite sq. ft. (12"x12") cost 1/16" $1.14. ⅛" $1.50. 3/16" $1.85. ¼" $2.20. Add 10% for postage. Almac Plastics. 600 Broadway. New York 12. N. Y.

PLEXIGLAS sheets—cut to size—clear, all thicknesses—standard outdoor translucent colors. McClarin Plastics. P.O. Box 168B. Hanover. Pa.

PLEXIGLAS. Lucite. Square foot cost 1/16"—$1.16. ⅛"—$1.53. 3/16"—$1.88. ¼"—$2.23. ⅜"—$3.28. ½"—$4.38. Colors add 10%. Send 15% for postage. Aristocrat Plastics. Inc., 55 Clarkson Street. New York City.

CASTING plastic. crystal like. new formulation. 1½ pounds liquid Numold and complete kit including colors and instructions. Start profitable hobby at home. make your own Christmas gifts. Only $6.00 postpaid. Information on request. Virginia Research Laboratory, Dept. B-11, Marion. Virginia.

UNUSUAL Christmas decorative materials included in complete plastics catalogue. Van Horn Plastics. 1905 Ingersoll. Des Moines. Iowa.

PLEXIGLAS. Fiberglas. Polyester. Acetate. Vinylite: Casting. coating plastics: Fast service. wholesale-retail prices. Catalog 10c. Gem-O-Lite. Box 6862P, North Hollywood. California.

PLASTIC Sheets. Rods, Tubes; etc. Free List. Plastic Supply Co., 2901 N. Grand Blvd., St. Louis 7. Mo.

PLEXIGLAS — any size sheet — Rod. Tubing. Dyes. Cements, Findings, etc. Free catalog. Parker Specialties, 9695 Monica. Detroit 4. Michigan.

MANUFACTURE plastic fingernail polish—instructions plus kit $2. Universal Manufacturing, Box 342. Westbury, N. Y.

NEW Liquid Casting Plastic. Clear, Colors. Embed flowers. insects, coins. Saw, drill, carve. Send 25c for Castolite Creations Manual and proved success plan showing how to make money at home. Castolite. Dept. M-102. Woodstock. Ill.

41 CHEMICALS & APPARATUS

NEW Idea Chemical and Apparatus Outfits for Home Experimenting Photo-Scales. Microscopes, Chemicals, Biological and Laboratory. Supplies in Small Quantities. Catalog 25c. Established 1931. John H. Winn. 124-B West 23rd Street. New York. N. Y

ILLUSTRATED Catalog: Chemistry, mineralogy. biology 20c. Tracey Laboratories. Evanston, Illinois.

CHEMICALS and apparatus for industrial, analytical and private laboratories. Catalog 25c. Dept. M-26, Biological Supply Co., 1176 Mt. Hope Ave., Rochester 20, N.Y.

CHEMICALS. Supplies. Catalog 20c. Laboratory Sales, Box 161-B, Brighton, Massachusetts.

GEIGER Counters, $29.95 up. Free catalog. Atomic Laboratories, Box 343, Berkeley, Calif.

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EXPERIMENTERS Supplies Catalog: 10c, refundable. Hagenow Laboratories, 2414 Clark, Manitowoc, Wisconsin.

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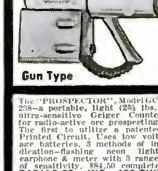

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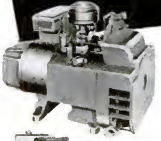

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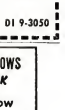

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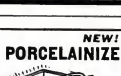

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$5.95 ppd.

Permanently porcelainize your laundry trays, new or old, at ⅓ the cost of new trays. Just brush revolutionary EV-R-SHIELD Glasecte inside your tubs. Glasecte hardens into a porcelain-smooth, seamless, gleaming white finish that never roughens. Strongest soaps, detergents, bleaches—even pure lye—can't mar or discolor it. Stays clean. Makes trays safe for finest lingerie. Leakproofs even cracked, leaking tubs. Satisfaction guaranteed. Complete kit contains easy instructions, special cleaner, 2 brushes, Fiberglas, Glasecte. Nothing else to buy or use! Order today! Amazing buy at only $5.95 ppd.

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FREE Free illustrated catalog saves up to 50% on choice pipes. All favorite shapes, plus collector's items from all over the world — briars, meerschaums, bamboo, calabash, porcelain, hand carvings, many helpful hints on pipes. Write today! Wally Frank Dept. D8 150 Nassau St., New York 38, N. Y.

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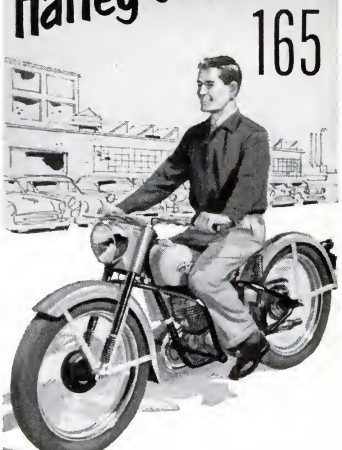
Enjoy 2-wheel drive pep, speed, extra mileage, performance—keep 4-wheel drive power and traction with WARN HUBS. Change 4-wheel to 2-wheel or back in seconds with fingertip control. Front end assembly stands still in 2-wheel drive—ends drag, stops shimmy, cuts front tire wear, increases gas mileage to 6 m.p.g. For Willys $69.95, Dodge $74.00 pr.; also Standard Hub for Willys $20.00, Dodge $23.00. Land Rover $24.00 pr.; Automatic Hub for Willys $120.00 pr., all ppd. Money back guarantee. Dealers or direct. Write for folder.

WARN MFG. CO., Riverton Box 6064-BD Seattle 88, Wash.

Why walk? Why drive?

GET TO THE JOB ON A

Harley-Davidson 165



WHY walk when you can ride? And why go through the agony of driving a car . . . when a 165 gets you there faster? It's the world's most practical transportation . . . safe, easy-to-ride and so economical, too. Lets you sleep later in the morning and gets you home earlier at night. Takes the irritating "jam" out of traffic . . . and there's *always* room for the 165 in any parking lot.

See the 165 at your dealer's now. Easy-pay plan. Send for *FREE* illustrated literature. Write: Harley-Davidson Motor Company, Department PS, Milwaukee 1, Wisconsin.

AVERAGES UP TO **80** *Miles per Gallon*

SAFE AND ECONOMICAL FOR SCHOOL AND PLAY

POPULAR SCIENCE MONTHLY'S . . . Last-minute news & notes

ATOM TREATMENT MAKES POTATOES KEEP 18 MONTHS without softening or sprouting. The gamma-ray "bath" did not affect taste in a test at Brookhaven National Laboratory ...THE A-BOMB FOULED UP ARCHAEOLOGY last year when radioactive dust from a Nevada test blast floated across to New York and settled on some prehistoric charcoal being "dated" with a Geiger counter. Made the charcoal read 1,000 years too young.

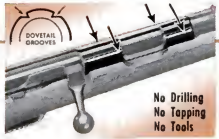
AUSTRALIA PLANS TO FREEZE A MOUNTAIN as part of a big water-power project. One side of the valley being dammed up is rubble that would let water seep out. Sealing it with concrete would be too costly. So the engineers expect to drill a network of 500-foot holes into which cold brine will be pumped, freezing the rock into a solid wall...BRAND-NEW DEVELOPMENT HOUSES ARE BEING USED AS SCHOOLS for children in two communities. The builders arranged the interiors into classrooms and leased them to the towns. When new schools catch up, the houses will be reconverted into dwellings...WHAT'S NEW: U.S. Rubber Co.'s all-rubber bed has a foam mattress and, instead of springs, inflated rubber tubes that you blow up to make as firm or soft as you like. With the double-bed size, you can make one side firm, the other soft ...American Kitchens Div. (Connersville, Ind.) builds new kitchen cabinets with wood doors, which many women prefer, and metal backs and sides, which are easier to hang on the wall...University of California at Los Angeles devised a rocket-powered hypodermic syringe that shoots medicine into internal organs at supersonic speed...University of Tennessee developed a new concrete block, half the weight of the standard type, that is laid with adhesive. The edges are ground true so that the blocks can be squared up without a level.

Japan's Fishing Fleet the Biggest

Twentieth Century Fund

U.S. AIR TRAVELERS will soon get their first taste of vibration-free turbine-powered flight--in foreign-made airplanes. Next April, Capital Airlines will start using British Viscounts, 48-passenger ships with Rolls Royce turboprop engines.

Big News for "22" shooters



Grooved receivers on many popular Savage and Stevens .22 cal. rifles adapt them for instant use with the new, sensational Weaver Tip-off 'scope mount.

Mount "Tips-on" or "Tips-off" receiver in seconds. 'Scope is aligned for immediate use. The mounting is low, rigid, sturdy.

NOW SAVAGE offers you these "22" rifles ready for INSTANT 'scope use

SAVAGE and STEVENS AUTO-LOADING RIFLES

These *Three-in-One Rifles* are instantly adjustable as autoloaders, bolt action repeaters or single shots . . . an exclusive Savage "first in the field" feature. Their simple, dependable, rapid firing actions may be quickly disassembled without tools. Choice of either tubular or clip magazine models (as listed at right) at popular prices.

Savage Model 6 Tub. Mag. $34.75

Stevens Model 87 Tub. Mag. $31.95 (shown far left)

Stevens Model 85 Clip Mag. $29.50

SAVAGE and STEVENS BOLT ACTION REPEATING RIFLES

Savage and Stevens bolt action repeating rifles—choice of either tubular or clip magazine models (listed at right) are recognized among small bore shooters for their fine performance, accuracy and outstanding value.

Savage Model 5 Tub. Mag. $29.50 (shown at left)

Savage Model 4 Clip Mag. $25.50

Stevens Model 86 Tub. Mag. $26.75

Stevens Model 84 Clip Mag. $23.75

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See them at your dealer's. Write for free catalog of Savage, Stevens and Fox Rifles and Shotguns.
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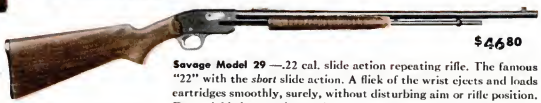
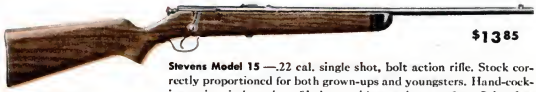


$46.80

Short forearm stroke—slide travels only 1½" in loading and ejecting.

Savage Model 29 —.22 cal. slide action repeating rifle. The famous "22" with the *short* slide action. A flick of the wrist ejects and loads cartridges smoothly, surely, without disturbing aim or rifle position. Dependable hammerless action . . . one-piece bolt—removable without tools for cleaning . . . single takedown screw . . . walnut stock . . . extra long slide handle, grooved for firm grip . . . accurate sighting equipment.



$13.85

Stevens Model 15 —.22 cal. single shot, bolt action rifle. Stock correctly proportioned for both grown-ups and youngsters. Hand-cocking action, *independent* of bolt, provides maximum safety. Other features include: Bolt handle directly over trigger for fast operation . . . new stock with handsome black-tipped fore-arm . . . 24" barrel . . . gold bead front sight and open rear sight with elevator.

Loaded NOT Cocked

Hand Cocked ↓ *Independent of Bolt*

Just dropping a hint to Ford owners

FALLING LEAVES are rustling out the message that *right now* is the time to have your Ford "winterized." Then you'll know it's ready to take on winter's roughest weather.

For one thing, you'll want your ignition system gone over . . . and, if new spark plugs or battery will step up its performance, insist on Genuine Ford Spark Plugs and Battery. You'll also want to have your cooling system protected with Genuine Ford Anti-freeze, permanent or regular.

When your oil is changed, a new Genuine Ford Oil Filter Element will keep it clean under winter conditions.

Always remember that you can depend on Genuine Ford Parts because they're made to specifications set by the same men who originally built your Ford.

WHEREVER YOU GO, INSIST ON

POPULAR SCIENCE
REG. U. S. PAT. OFF. Monthly

Sonic Magic

A new way to cut things did these tricks—see next 3 pages

Sonic Magic: Silent Screams Carve Hardest Materials

Microscopic chisels powered by sound waves are replacing the diamond in industry—and may mean painless dentistry for you.

By Alden P. Armagnac

SOON your dentist's chair may be just a nice place to lean back and relax. That is the promise of a newly introduced, painless dental drill, an instrument that looks like an overgrown mechanical pencil at the end of a flexible tube.

END OF TABLE FORK, used as tool, pierces glass tumbler in less than a minute's time.

Unlike the dentist's traditional rotary drill, this radical new type has neither rotating bur nor whirring drive cord. Its tiny blunt tip cannot be seen or felt to move. Actually it vibrates a microscopic distance, 29,000 times a second. By imparting this mechanical motion to particles of aluminum-oxide powder suspended in water it drills teeth gently but effectively.

Employing the magic of silent sound, vibration too rapid and high-pitched for human ears to hear, ultrasonic tools now cut the hardest and most brittle materials with ease. The new dental drill is the latest of them; its big brother, an ultrasonic machine tool, has already made its debut in industry. At the Cavitron Equipment Corp. plant and laboratories in Long Island City, N. Y., where both were in-

INTERCHANGEABLE TOOLS for ultrasonic cutting machine yield variety of useful and ornamental carvings. "Cookie cutter," left of center, turns out 37 jewel-bearing blanks at a time.

INTRICATE SHAPES are cut with ease in "unmachinable" materials by ultrasonic tool. Examples are these tungsten-carbide dies and, at right of center row, a tool-steel gear mold.

THERE'S NO DANGER in touching ultrasonic cutting head in action, as above. It feels greasy when it's running, but not when it stops—a mystery that no one can explain.

vented and developed, you see these wonder-working machines in action.

Just as a housewife slices vegetables and cuts cookies, an ultrasonic machine tool slices lumps of synthetic ruby and sapphire into wafers—and then neatly cuts out round and perforated blanks for jewel bearings of watches and meters.

Ultrasonics Replaces Diamonds

It "dices" brittle germanium into minute squares for the tiny transistors that are replacing vacuum tubes nowadays. It carves dies of intricate shapes from ultrahard tungsten carbide—a material that could be cut, until recently, only with diamonds.

As easily, it does spectacular stunts. Using as cutting tools the cut-off ends of a table fork, a cheap pocketknife blade and a drugstore nail file, it thrusts them respectively through a glass tumbler, a drill bit of high-speed steel and a husky machine-shop file. In the photos of the feats on page 97, fork, knife and nail file are exact duplicates of the ones actually used.

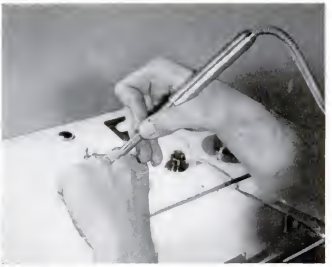
Ultrasonic machining had its beginnings in 1942 with experiments by a Cavitron staff physicist, Dr. Lewis Balamuth. Silent sound, he knew, had the remarkable power of blending substances like oil and water, which ordinarily will not mix. What would happen, he wondered, with materials as utterly foreign to each other as liquid mineral oil and solid, insoluble Carborundum powder? To satisfy his curiosity, he suspended an ultrasonically vibrating nickel tube in a glass vessel containing the mixture.

What happened was the last thing anyone would have expected. The tube began cutting a hole in the glass! And the ring-shaped hole was exactly the size and shape of the tube's end.

"Hammer" Drives Microscopic Chisels

Hardly believing his eyes, Dr. Balamuth pounded the end of the nickel tube out of shape, and repeated the experiment. This time the tube cut a hole of just the same irregular shape as its mashed end. No doubt remained of the

PAINLESS DENTAL DRILL draws power from cabinet in background. Unconventional glass-toothed model of jaw tested experimental design's convenience of use in any position.



DRILL IS HARMLESS to flesh, as shown. The latest model supplies its own dental cutting fluid: aluminum-oxide powder suspended in water. Eye dropper applied it in first trials.

explanation. The vibrating tube was acting like a hammer upon the tiny particles of abrasive in the liquid, driving them like miniature chisels against the inner surface of the glass vessel. There, they carved the precise image of the tube's end. By the same principle, a tool of any shape whatever could cut its likeness into the most resistant material. Only the abrasive particles would need to be hard; the tool itself could be of relatively soft, easily shaped metal.

Machines Are Already at Work

First machine to put the discovery to practical use has been the industrial model developed by the Cavitron firm, with Dr. Balamuth as research consultant. More than 100 of these have been built, and leased or sold to several dozen leading manufacturers.

In general appearance, this model resembles a milling machine. A power-supply cabinet on casters, beside it, feeds 1,000 watts of variable-frequency alternating current to a water-cooled cylinder, the heart of the machine.

A coil within the cylinder magnetically constricts and relaxes a vertical drive shaft of nickel at an adjustable rate centering around 25,000 times a second. At the same rate, a toolholder screwed to the free lower end of the drive shaft dances up and down. So does any cutting tool, conventional or unconventional, that has been brazed or screwed to one of the interchangeable toolholders. But the tool's stroke is so short, only one or two thousandths of an inch, that you cannot see it move.

To advance the tool against the work, this counterweighted cutting head descends by gravity, sliding vertically on ball bearings. Meanwhile, two nozzles direct streams of water containing an abrasive powder—aluminum oxide or boron carbide—at the tip of the tool.

Swiftly the tool sinks into materials as varied as hardened tool and die steels; boron, tungsten and titanium carbides; glass, fused quartz and ceramics; granite, marble, gem stones. A needle circling a depth gauge shows its progress.

Only sign of its ultrarapid vibration is that it turns the water to mist, with a gentle hissing sound. That's all you hear, instead of the usual noise of machinery.

Tool Is Safe to Use

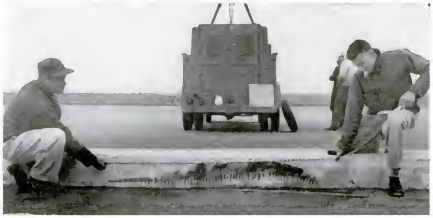
You can touch any moving part, even the cutting edge, without harm. The tool cannot cut flesh, but only unyielding materials—the harder, the better.

News of the ultrasonic machine tool's recent introduction brought unexpected queries to the makers.

Dentists were interested in the possibility of drilling teeth by ultrasonics—among them Dr. Carl R. Oman, professor of dentistry at Columbia University's

[Continued on page 260]

Beefed-up sedan whams into test curb on Sacramento airport. Driver, strapped in, was unhurt.

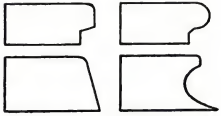


Tire marks show how this curb nudged the car back into lane.

Test crew looks over damage to the car in high-speed crash.

What's the Best Shape for a Curb?

To FIND out, A. W. Kessinger, a test driver for the California highway department swerved his '49 Ford 149 times into curbs of 11 shapes at 5 to 50 miles an hour. He wrecked 12 A frames, 10 wheels, two tires, one tie rod. And he found the shapes shown below, in 9- and 12-inch heights, most effective in keeping the car in lane. Officials plan more tests to pick one best design to separate future dual highways.



Wooden Gun Trains GIs in Japan

THIS working demonstration model of the M2 carbine was built by GI craftsmen to speed the training of U.S. forces in Japan. Army instructors there say 85 percent of a man's learning comes from thus seeing how things work.

Plane Nearly Lifts Its Weight In Fertilizer

WHAT looks like smoke pouring from the light plane at left is fertilizer—1,250 pounds of it. The plane itself, a Fletcher FU-24 built in Pasadena for this special chore on New Zealand farms, weighs only 1,909 pounds. It has a 225-hp. motor.

F-100's Roar Is Choked Off For Line Test

THE tailpipe of North American's F-100 Super Sabre at right juts into a silencer unit fitted with a nearly soundproof collar. This deadens the roar of preflight operations, which are the last step on the production line.

Big Turboprop Transport Takes Off in Unusually Small Space

GETTING off the ground in one-third of the run most planes of its size must make, the Air Force's new YC-130, made by Lockheed, is seen above during tests at Edwards Field, Calif. The big transport, which loads through a rear door under its high tail, has four 3,750-hp. turboprop engines and can carry up to 20 tons.

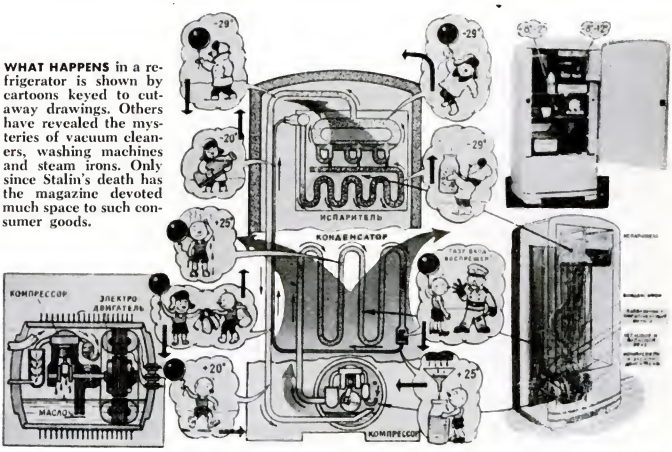
STUDY OF SCIENCE in Russian schools begins at age of seven. From high-school level, nearly half students' time is spent on it. In college, science majors outnumber those in the U.S.

available in quantity, the natural urge to tinker and make things—generated by mounting technical indoctrination—is channeled into industry rather than into the home workshop or garage.

"Science-of-tomorrow" articles are included as a further stimulant. Most of these look ahead only a few years. One was an imaginative description of a fully automatic factory for mass-producing leaf springs for vehicles.

Occasionally sights are elevated to picture atom- and rocket-power aircraft, massive seaplanes in exotic shapes, and simple, one-man helicopters. Another re-

[*Continued on page 262*]



WHAT HAPPENS in a refrigerator is shown by cartoons keyed to cutaway drawings. Others have revealed the mysteries of vacuum cleaners, washing machines and steam irons. Only since Stalin's death has the magazine devoted much space to such consumer goods.

Plumbers' Olympics Stress Their Skills

CONTESTANTS bunked and ate in Purdue halls, were graded by University professors.

Union and university honor America's best apprentices.

FOR three busy days, 70 of the best apprentices serving the plumbers and pipe fitters of America competed at Purdue University for prizes totaling $3,500. They took long written exams, and vied in lead wiping, pipe-bracket welding, copper-tube sweating, valve assembling and several other aspects of plumbing in this first national plumbing Olympics.

The United Association of Journeymen and Apprentices of the Plumbing and Pipe-Fitting Industry, an AFL union, sponsored the event on the West Lafayette, Ind., campus with the help of industrial, engineering and scientific groups. Why?

"We are not adding sufficient apprentices to guarantee our continuation as a craft organization," President Durkin of the union explained. "Craftsmanship in the building trades is being watered down. It is our obligation to industry, the general public and government to organize our apprentice program so that after the scientists and engineers have done their jobs we can step in and construct any plant or building."

Men from 36 states and three Canadian provinces who are now in their fifth and last year of apprenticeship demonstrated their skills at Purdue after winning state contests. Their expenses and wages for a week were paid by the AFL locals that they represented.

IN UNIVERSITY SHOP, apprentice plumbers showed their skill at welding by making triangular pipe-support brackets. Each contestant brought along his own kit of hand tools.

MOST SPECTACULAR TEST required pipe fitters to cut pipe of half-inch steel and weld it into a double-jointed 90-degree bend, using both acetylene torches and arc welders.

PLUMBERS often must hoist pipes. So they must know how to tie knots and signal to others. Here a bowline tied by one of the apprentices is being given a thorough examination.

PIPE FITTERS looked their welding work over critically before the engineering-college faculty judged it. Reporters were the only spectators who were allowed in the test room.

$1,000 PRIZES were won by Freeman Kincaid, 32, of Los Angeles (shown at left below, doing lead work), and Robert Berns, 25, of Milwaukee. Kincaid was judged the best plumber, Berns best pipe fitter. Martin P. Durkin, union president and former U.S. Secretary of Labor, presented checks at banquet climaxing the contest. END

Dragster with Slant Nose Hits 144 M.P.H.

REAR tires smoke as Don Yates takes off near Los Angeles in this dragster for a quarter-mile run that hits 144 m.p.h. The car weighs a third as much as a medium-size passenger job, but gets 400 hp. from its Mercury V-8.

Plastic Window Gives Sky View

WANT a window on top of your car? You can get one as an accessory—tinted plastic that fits in a hole you jigsaw in the roof. Screws hold it in and a special compound seals the edges. Key Kap Co., 739 S. Main St., Dayton, Ohio, makes it.

Tubing on Wire Makes Ladder

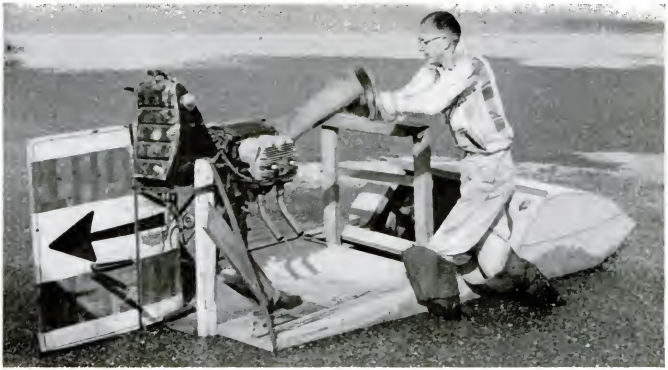
IT'S like stringing beads. Mrs. Constance Miller of Esher, England, pulls the wire on which some pieces of tubing are strung—and there's a sturdy, rigid, eight-foot ladder for the window-cleaning job. The collapsible ladder, called a Rollarod, was invented by Mrs. Miller's husband.

Truck Squeezes Load to Lift It

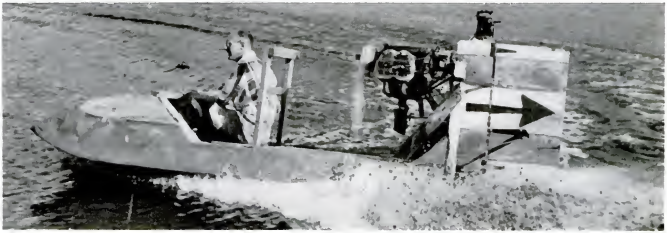
THIS fork-lift truck works without forks. It has arms that squeeze the load from the side. That way it can pick up a stack of cases even when they are not piled on a wooden pallet platform. The Warehouser is made by Yale & Towne Mfg. Co., Roosevelt Blvd. and Haldemann, Philadelphia 15.

Airboat Speeds Up Cranberry Harvest

THIS is the way John Garretson Jr., a Navy war veteran, harvests his 40 acres of cranberry bogs on Cape Cod, Mass. Instead of wading and raking berries from the submerged vines, he just cruises the flooded bogs in a shallow-draft airboat.



Garretson cranks prop-driven boat. Under way (below), turbulence shakes berries off vines.



A convenient breeze floats berries to one corner of bog, where they are scooped into boxes.

Their Tallest Tales Are True...

"SAM THE WEATHERMAN," veteran cooperative weather observer, notes the temperature at Plainfield, N. J., on Dec. 26, 1947, the day he recorded that area's record-breaking 23-inch snow.

SKI LODGE LIES ALMOST BURIED under drifts in Rainier National Park, Wash., where annual snowfall totals 40 to 50 feet — the most anywhere in the U. S.

Ten Thousand Hardy Amateurs Record Your Weather

INSTRUMENTS supplied to volunteer weathermen include this swivel psychrometer (a pair of wet- and dry-bulb thermometers) that Sam is shown resetting after recording the humidity.

SAM MEASURES RAINFALL on Government gauge in his back yard. Rain falls into open cylinder and funnels into a smaller tube that thus "magnifies" the amount for easier reading.

Volunteer U. S. observers win law suits, help business and settle neighborhood disputes.

By Herbert Yahraes

SOME time ago a lean, elderly man with a white mustache took the stand in a New Jersey court. It was a divorce case, with the husband charging unfaithfulness. The principal witness had testified to standing in the street one night and noticing certain goings-on in a room on the second floor.

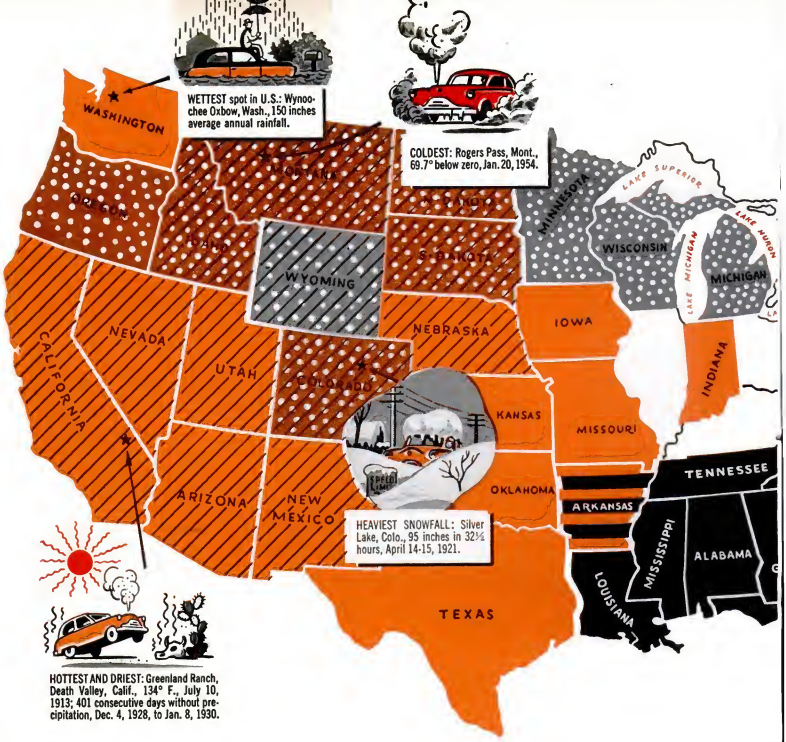
The new witness—called by the defense—identified himself as Samuel K. Pearson of Plainfield, N.J., a cooperative observer for the U.S. Weather Bureau. His work for the Government, he explained, required, that he keep careful records of each day's weather.

Did he have a record for the evening in question?

Pearson did. He referred to an official form. During all the time that the other witness had been standing in the street, peering upward into a second-story room, the weatherman testified, a thunderstorm had been raging.

Pearson has ruined many another case during his 49 years of observing the weather. A storekeeper once sued a municipality to recover damages he suffered when a sewer became clogged during a rainstorm and the backed-up water flooded his cellar and ruined his goods.

It looked like an open-and-shut case until Sam the Weatherman—as his letter-



head reads—took the stand. "How much rain fell on the fifteenth day of August?" he was asked.

Sam consulted his records and replied, "Not a drop."

Sam has helped win cases, too. A man who had slipped on the ice was suing for damages. Because of a defective leader, he claimed, water from melting snow on the roof had run over the sidewalk and frozen.

The defendant's lawyer ripped into the weatherman. How could water be flowing from the roof while freezing on the sidewalk?

Easy. Sam's temperature record for the time of the accident showed the mercury at 30 in the shade—cold enough to have frozen the water on the walk. But the roof, heated both by the sun and by radiation from the house, could well have been warm enough to melt snow.

Volunteer Records Reveal Our Climate

Pearson is one of almost 10,000 men and women who have volunteered their services to the Weather Bureau. Officially they are known as cooperative weather observers.

Like Pearson, many of them are called on as expert witnesses, but testifying is only a sideline. Many of them also do

It Gets Awfully Cold Here . . . Also Hot

KEY

HOT: States where temperature has gone over 115° F.

COLD: States where temperature has dropped under 50° below zero.

WET: States with annual rainfall of more than 48 inches.

DRY: States with annual rainfall of less than 24 inches.

It's largely the cooperative weather observers who have told us what we know about our coldest, wettest, hottest, and driest places. But records are records, Weather Bureau meteorologists point out, merely because someone happened to be there to observe what happened.

Up till this year, the lowest recorded temperature in the U.S., outside of Alaska, had been 66° below zero—observed at Riverside Ranger Station, Yellowstone National Park, Mont., in 1933. But on January 20, the cooperative observer at Rogers Pass, Mont., recorded 69.7° below. The Bureau called in his thermometer for calibration and two months later announced the new record.

Other states where the thermometer has fallen to at least 60 below are Colorado, Idaho, North Dakota and Wyoming. There isn't a state where the temperature hasn't dropped below zero at some time or other. Florida's record low is the highest in the country—two below zero, at Tallahassee on Feb. 13, 1899.

The hottest and driest region of the country is the desert area of Arizona and Southern California. Summer temperatures above 120° are not uncommon, and occasionally there is no rain for a month or more.

The highest temperature ever recorded in the United States was 134° in Death Valley, Calif., one July afternoon 41 years ago. Death Valley had the record drought, too—more than a year without any precipitation whatever.

Washington, though drier than most states, has the wettest single spot in the country. It also has the place that gets the most snow: Paradise Ranger Station in Rainier National Park, which averages 571 inches a year. That's over 47 feet!

some unofficial forecasting, but that's only a sideline, too. Their real job is to record the American climate.

To that end, the observers—spotted across the land at least one to a county—read their Government-supplied instruments every day and send in detailed reports every month. Without their work, precise knowledge of the climate of the United States would be limited to those comparatively few areas where the Bureau has full-time, paid weathermen.

You might be surprised to know all the uses to which climatic information can be put. For example, a big chain-store company wanted to determine as scientifically as possible just where and when it ought to be well stocked with umbrellas, heavy clothing and other seasonal items. So it asked the Weather Bureau for data about the temperature, rain and snow in every town where it had an outlet. Thanks to the work of the cooperative observers, the Bureau could oblige.

Where Can You Grow Castor Beans?

Similarly, a maker of snow tires wanted the dates of the earliest snowfalls in scores of communities across the country.

A manufacturer of castor oil knew where castor beans were already being grown. Now he wanted to know the

climate of those areas, in terms of rainfall, temperature and sunshine, so that he could look for similar areas elsewhere in this country and abroad. The Bureau got him the information quickly; it was all in the records piled up by its volunteer assistants.

These records are published monthly for each state and are also kept on punched cards at the National Weather Records Center at Asheville, N.C. If anyone wanted to know, for example, all the places in the U.S. where the temperature reached five above zero on a certain day 10 years ago, the cards could come up with the answer in only a few minutes' time.

The information collected by the unpaid weather workers is also used to help select industrial sites, design building materials, establish premiums for insurance against storm damage, set specifications for gasoline and lubricants, determine the loan value of farm lands, and choose the types of clothing and equipment to be issued for Army personnel.

WEATHERMAN Arlington E. Race of Spencertown, N.Y., is also a full-time policeman, a volunteer fireman and the township tax collector.

Let's look in on a typical observer—Arlington E. Race of Spencertown, N.Y. Race is a full-time police officer; he is also a volunteer fireman, township tax collector, trap drummer in a dance orchestra and a sign painter. Yet every evening for 25 years—and before that, for nine years at Hudson, N.Y.—Race has been going out to the louvered shelter back of the house promptly at six o'clock and noting the temperatures on the two Government thermometers hanging there.

One instrument registers the maximum temperature reached during the last 24 hours; the other, the minimum. After reading them, Race resets the thermometers in accordance with a page of detailed instructions issued by the Weather Bureau, closes the shelter, and looks at his rain gauge. In wintertime, if there has been snow, he measures the depth not only in the gauge but also at several representative spots on the ground. Then he carries the gauge inside and melts the snow so he can measure the actual precipitation. (Snow varies widely in its wetness; on the average, though, one inch of snow is equivalent to one-tenth inch of rain.) Finally, Race enters his findings on a permanent record form.

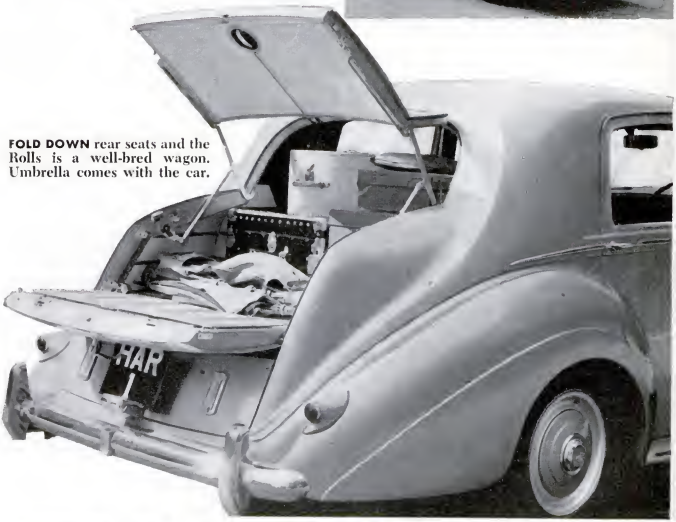
"This work isn't hard," he comments, "but it is confining."

It can be hard, too. One December afternoon in 1947, for example, George P. Kirsten, the observer at Ridgefield, N.J., left his job in a New York City bank at 2:30. It had been snowing for hours. Unable to get across the George Washington Bridge, he took a ferry to the New Jersey side of the Hudson River and began the four-mile trudge home. Climbing the Palisades, he fell a dozen times but made the top. Then he stumbled, and was too exhausted to rise. The snow covered him. About five o'clock a truck came along and almost ran over his leg. The driver shook him awake and gave him a lift home. Thereupon, Kirsten shoveled through snow up to his knees to get to his instrument shelter.

A Weather Bureau volunteer can't help

[Continued on page 268]

Discreet Rolls Royce Has Hidden Luxuries for Roughing in Style



FOLD DOWN rear seats and the Rolls is a well-bred wagon. Umbrella comes with the car.

A teacup could rest on the retractable radio.

AMERICANS who take the half-ton pick-up when they go out loaded for crow will—if also loaded with dough—be interested in the Rolls Royce Countryman Saloon. Though dignified enough to cause no embarrassment in town, it is "a most luxurious shooting brake." For your $14,000 you get special coachwork on a Silver Dawn chassis. If the field trial or grouse shoot is just too fatiguing, you have a wash basin in which to freshen up, an electric shaver for that blue shadow, a cup of hot tea from an electric kettle to revive languid spirits, and a cocktail bar if the tea won't do it. (If all else fails, the front seats fold into a bed.) In the morning the sun pours in the "sunshine roof."

Dummy Stands In for You in Tests

MEET Mark III. A 200-pound six-footer, he risks plastic flesh and metal bones in aircraft safety tests. Alderson Research Labs., 10 E. 38th St., NYC, designed it to duplicate a big man.

Carburetors Tested in Bubble

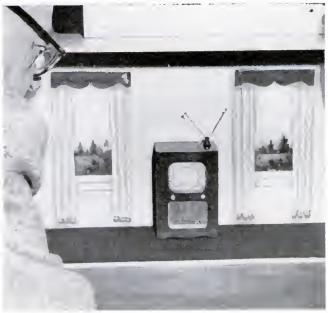
A GIANT bell jar fitted with vacuum pumps (above) makes altitude to order for carburetor tests. Ford research engineers use the plastic bubble to simulate the rarefied atmosphere of the mountains or the seashore's denser air.

Big Crash Crane Picks Up a Bomber and Rolls Off with It

THE Dutch crash crane above can lift a 17½-ton plane like this B-25 and tote it to a hanger. The tractor acts as a forward counterweight, while, for lateral stability, the rear axle can be extended to increase the wheelbase almost four feet. A pump run by the tractor's 200-hp. diesel engine supplies hydraulic power to operate the crane.

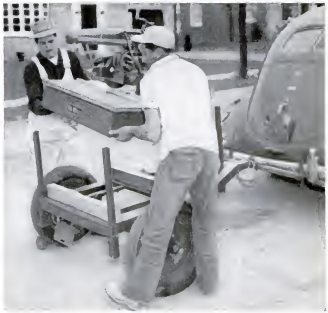
Light Plane Lowers Supplies in a Bucket, Helicopter-Style

A LIGHT plane makes like a helicopter to lower supplies to missionaries in the Ecuadorian jungle. The trick is to fly a tight circle at low altitude. This makes the supply bucket, on the end of a 1,500-foot line, move to the center of the circle and sink gently to the ground. It stays there for easy unloading (above left) so long as the plane flies the circle. Originated by Nate Saint of Quito, Ecuador, a Moody Bible Institute pilot-missionary, the technique is shown being demonstrated near Chicago.



Tiny TV Has One-Inch Screen

PROBABLY the world's smallest TV set, this dollhouse unit was built by Tom Stuart, electronics engineer at the Naval Supply Center in Norfolk, Va. It really works—for viewers who sit close—producing sharp images of telecasts on its one-inch screen.



Portable Saw Rolls to the Job

WILLIAM M. MURRAY & SON, builders in Landis Valley, Pa., rigged up this trailer to haul a radial saw to job sites. The traveling shop pulls up in front of a house, and two men tote the 200-pound power tool from room to room.

By Col. Bernt Balchen

How You'll Fly Within 50 Years

Europe in two hours, in a glass airliner cruising 20 miles above the earth, may be a routine flight in the year 2000.

THE speed of future airliners will be determined by how fast the passengers can be accommodated in comfort. It will be hard to cut flight time between London and New York to less than 1½ to two hours. Take-off and climb to cruising altitude must be carried out gently and gradually, because there is a limit to the acceleration a human being can take without blacking out.

Descent and landing will also require a reasonable time. Presumably, take-off and landing together may take 45 minutes, while the flight itself will take only an hour.

To do this, aircraft will fly at 2,000 to 4,000 m.p.h.

Such speeds are likely to be the most common speeds for "short" trips, like the hop between London and New York. On a longer flight, say from Montreal to Rio de Janeiro, which could also be flown in approximately two hours' time, cruising speed will be close to 8,000 m.p.h.

The author

When Bernt Balchen talks about flying, he speaks with the authority of 30 years as a flier. He is also an old Arctic hand who has winged often over the top of the world. During World War II he commanded a far-north U. S. air base. He is now Arctic adviser to the Air Force. This article is from his new book.

Convertiplanes for short trips. New York to Washington takes one hour today and will probably never be cut to less than half of that. The aircraft used will not climb to very high altitudes. It may pay off to use slower convertiplanes, in order to be able to land in the downtown areas. You and your friend may board two airplanes in New York and leave for Washington and London, respectively, at the same time. The moment you hit the runway at National Airport your friend is being requested to fasten his safety belt and his plane is beginning to glide down toward the London airport.

Longest trip—two hours. No long-distance flight in 1980-90 will take more than a couple of hours, in all prob-

From The Next Fifty Years of Flight, *by Bernt Balchen and Erik Bergaust,*

ability. The greatest distance on earth is halfway around the globe at the equator, 12,541 miles. An airplane flying at 8,000 m.p.h. and requiring 30 minutes for take-off, climb and landing will make it in two hours. That may be the limit as far as commercial planes are concerned, but pilotless missiles and military fighter planes may fly even faster.

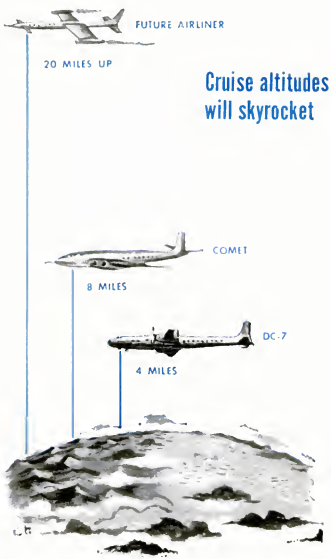
Such great speeds will confuse passengers because of differences in local time. If you leave London after breakfast at eight o'clock, you will arrive in New York at five o'clock the same morning and have to wait three hours before your friends eat the meal you had five hours before. The best schedule might be to leave London around midnight and arrive in New York "yesterday" at nine o'clock in the evening. If you go to a 10-o'clock show on Piccadilly before you leave, you can still make another 10-o'clock show on Broadway—and go to bed about the same time that you left the London airport!

Nonstop anywhere. Planes capable of these speeds will fly nonstop between London and New York without refueling. Today, U.S. bombers can fly direct from the United States to Tokyo; tomorrow, or let's say 30 years from now, the need for a refueling stop will have been eliminated altogether. All flights will be point-to-point, whether from Africa over the Antarctic to New Zealand, or from New York over the Arctic to Hong Kong.

The number of passengers accommodated on these flights might be in the neighborhood of 300. This, however, depends more on the traffic demand than the ability of the airplane manufacturer to build large planes.

As a parenthetical thought, I hope

Cruise altitudes will skyrocket



Flight at thousands of miles an hour will take place at great altitude—possibly 100,000 feet—where air is extremely thin. Otherwise, air friction would make the plane too hot to live in, even with artificial cooling. Most airliners today fly at 20,000 feet or below, though jets go over 40,000.

Distance will mean nothing

It will make little difference whether you fly from San Francisco to New York or San Francisco to London. Time spent in level flight will be about the same. The time-consuming parts of the trip will be the climb to, and descent from, the selected cruising altitude.

copyright, 1954, by Erik R. Bergaust; published by Harper & Brothers.

Transport planes shrink the ocean

we will gain toward simplicity in customs and immigration regulations. There isn't much sense in flying from New York to Tokyo in two hours if the customs, immigration and passport people are going to hold you up for an equal length of time—longer, actually, than it will take you to travel halfway around the globe.

1919

Alcock and Brown flew nonstop from Newfoundland to Ireland, some 2,000 miles, in 16 hours.

Flying iceboxes. Tremendous research work is required to bring about such fantastic speeds. An airplane flying at 8,000 m.p.h. must resemble a flying icebox because of the friction heat. Flying at 4,000 m.p.h. with today's planes would cause the fuselage to hit a temperature of 1,500°. Skeptics claim that it is impossible to insulate the cabin and the entire plane against such temperatures. However, they seem to forget that aircraft like the passenger planes of 1990, flying at speeds five times that of sound, will operate at such speeds only in extreme altitudes, where the air is so thin that friction will have a much lesser effect. The heat may rise to 200° while the aircraft climbs at more than 1,000 m.p.h., but it will drop substantially if the plane cruises at 100,000 feet, where the air pressure is 0.2 pounds compared to a pressure of 14.7 at sea level.

1927

Lindbergh made first New York-Paris nonstop flight—3,600 miles—in 33½ hours.

While these temperatures do not offer insurmountable barriers, they will still be difficult to overcome. Certain alloys can stand constant heat of hundreds and thousands of degrees. But aluminum alloys can't take very much. Improvements in the fields of metallurgy and insulation, with new materials and lubricants, will be necessary to produce the "guts" of these hermetically sealed "flying iceboxes" of the future.

1939

First passenger service required intermediate stops. Flight of 3,460 miles, New York-Southampton, took 34½ hours.

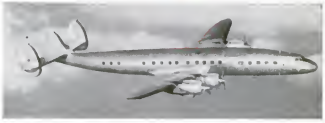
Even glass rivets. The exteriors of these superplanes will be made of glass. The plane will have a glass fuselage, glass wings, glass ailerons and glass stabilizers. Even the rivets will be made of glass.

Phenolic-resin-impregnated glass-fabric materials show practically no loss of strength at the temperatures mentioned above, and maintain half of their mechanical properties even at temperatures around 500°. (Aluminum or magnesium alloys lose much of their strength above 300°.) It is also possible to laminate woven-glass fabric with various silicones, which are heat-resistant. Using these materials, the whole airplane can be molded, and production will be simplified and made less costly.

The major structural members will be of stainless steel, titanium and other heat-resistant metals.

Stainless steel can be exposed to extreme temperatures without loss of its mechanical properties. But steel is heavy, and thus only the most important members in fuselage and wing will be made of this metal. Titanium, on the other hand, is light, besides having a good strength-weight ratio and heat-resistance. Titanium will be used extensively also because of its ability to resist dynamic creep resulting from tension and torsion.

1954



Today's piston-and-propeller airliners span Atlantic in 12 hours. More powerful versions will better this before year's end.

Helium to cool surface. Good results in cooling aircraft may be obtained, I think, through the use of liquid helium. Helium, which has a boiling point close to absolute zero, might be pumped out to flow over the surface toward the rear of the craft and then vaporize. This should provide very effective cooling for the short periods of time while the aircraft accelerates up to the outer layers of the atmosphere, where little cooling is required.

1955-56

Soon, perhaps next year, jet airliners will fly the ocean in as little as six or seven hours.

The high temperatures and speeds encountered in tomorrow's flying will also require different lubricants. We may be using dry lubricants in these aircraft.

We will have to improve our engines and fuels substantially. Regular jet engines can be used for speeds up to two or three times that of sound. But at 2,000 m.p.h. hydrocarbon fuel will begin to boil. Also, at altitudes of 100,000 feet or more, there is very little oxygen for the jet to swallow.

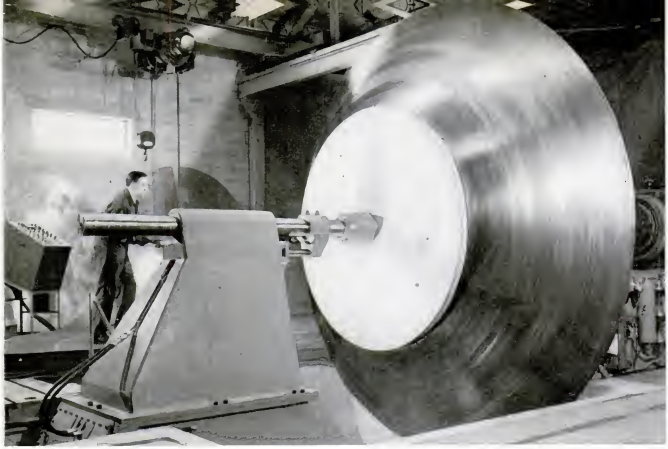
Ramjets will give speed. Airliners of tomorrow may have powerful turbojets for take-off and slow landing speeds, while ramjets take over during normal flight, giving fabulous cruising speeds.

2000

In the next half-century, transatlantic airliners will cross in 1½ to two hours.

I think that there is a great future in nuclear energy, but I believe that there is a lot to be done in the field of jets and rockets with improved fuels and less complex engines. I predict that we will experience a rocket age, commencing during the latter part of this century.

The rocket represents the optimum of simplicity, and unlike any other heat engine, the rocket is not dependent on the surrounding air. In fact, the rocket will perform better in a vacuum, where there is no air resistance. END



Largest Spinning Lathe Twirls Sheet Metal into New Shapes

After pushing buttons, a workman just stands by to watch while this huge spinning lathe forms flat sheet metal into a 14-foot dome. Hydraulically controlled, it has a 50-horsepower drive and a 180-inch swing. The Phoenix Products Co., Milwaukee, built it to spin huge shapes for air-conditioning equipment and industrial machinery.

TV Actors Wear New Mike

A television actor can't get out of microphone range with NBC's new mike—he wears it concealed in his clothing. It is hooked to a tiny radio transmitter, made with transistors, which relays his voice to a studio antenna that feeds the station transmitter.

Hood Air-Conditions a Tractor

The Air-Brella on the farm machine above cools as well as shades the driver. Air drawn in by a fan at the top flows down the sides, swirling around the farmer but never blowing directly on him. It is made by the Farmhand Co., Hopkins, Minn.

How Hi-Fi Records Are Made

New mikes, magnetic tape, a hot stylus and hotter technicians make the listener feel he's actually sitting in a concert hall.

EVER since Caruso first bellowed down a tin horn to give the world a faint idea of the grandeur of his voice, the making of phonograph records has involved compromise.

The degree of compromise between live and "canned" music used to be ludicrously wide. But now, hi-fi records have nearly closed the gap.

Perhaps the biggest share of credit for this improvement in the music in your home goes to magnetic tape and the industry-wide use of feedback cutters.

All major recording companies now begin the creation of a record by capturing live music on 2,400-foot reels of magnetic tape, running, in most cases, at the fixed speed of 15 inches per second. These tape "masters" are capable of reproducing the original sounds with nearly complete faithfulness.

The feedback cutter permits the re-

1 THIS MAN IS "MIXING" MUSIC for a master tape recording. His left hand is working controls that regulate the volume of the five microphones picking up the orchestra's sounds. The mixing panel provides controls for as many as 10 microphones, which sometimes are needed.

2 A "PLATTER" BEGINS LIFE at M-G-M Records. Music from the master tape on the machine at far left is being transferred to the master disk, on the recording lathe at far right.

cording of peak volume with minimum distortion and maximum consistency.

Another recent invention, which stands between the recording orchestra and the master tape, is of vital importance to the making of hi-fi records. It is the condenser-type microphone. Its name derives from the fact that its vibrating diaphragm acts as a condenser. This microphone more exactly reproduces sounds—especially in the high frequencies, from 15,000 cycles per second on up—than any other yet made.

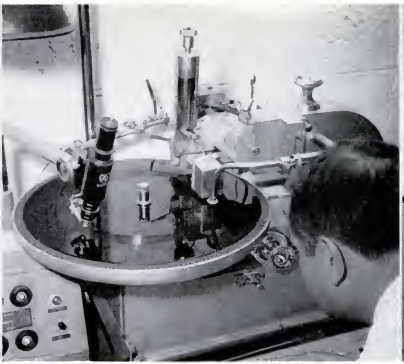
Then, there is the equalizer, an electronic device that enables a skilled operator to boost or reduce low, middle or high frequencies coming off the master tape. In this way, as the music is transferred to a master disk, he can help make up for deficiencies of recording due to faulty placement of microphones in the recording studio.

Hot Stylus Cuts Like Hot Knife

A fourth valuable contributor to the making of hi-fi records is a thin heating wire. It has been wound around the cutting stylus, which etches sounds on the surface of the master disk. Six volts of current are applied to this wire when the stylus is at work. The result is, in effect, to sharpen the stylus, so that it does a cleaner job, just as a hot knife does a neater job at cutting gooey cake. Sharper cutting of records makes for less distortion in reproducing the sounds on them and reduces surface noise.

Until fairly recently, recording equipment was better than the phonographs available to play what it produced. Technicians could afford to be somewhat careless. No record buyer would ever hear the difference. Now that the number of people owning sensitive hi-fi sound-reproducing systems is growing at a dazzling rate, every recording technician must be on his toes as never before. Any slipshod work will be painfully evident to a multitude of ears. Every hi-fi record starts its journey to the public's jukeboxes and living-room phonographs in a scientifically designed studio.

In a soundproof control room outside the studio, behind a wall of clear glass, a man called a "mixer" blends musical ingredients as the musicians record their work on the master tape. He controls the volume of every mike from where he sits,



3 CUTTING A MASTER DISK for a 12-inch long-playing record. The curving tube at right is a suction pipe, collecting "chip" from the cutting stylus, mounted next to it. The microscope is calibrated for checking the dimensions of the grooves being cut.

4 "VARYING THE PITCH" doesn't mean changing the key of the music being recorded. It means changing the number of grooves being cut per inch. Soft music can be crowded into less space than loud. This operator follows a musical score to see which is coming next.

and it is his aim to balance them so that the over-all effect is what the composer or arranger had in mind.

If a clarinet reed suddenly makes a noise like an indignant peacock, or a singer develops a frog, then the players repeat that passage. This will go onto a second tape. Several are made before the musical director is satisfied.

Snip Go the Bloopers

In the recording company's disk-mastering room, a technical expert later snips the "bloopers" from an otherwise excellent tape and replaces the cut-out sections with corrected strips from the other tapes. When he has a thoroughly corrected master tape, he first listens to it through a playback amplifier. He makes note of where he must use his equalizer to improve on the mixer's work. Then he is ready to transfer the music from the master tape to the master disk.

The disk, a lacquer-coated circle of aluminum, lies on the turntable of a recording lathe. This machine is a highly intricate and accurate overhead lathe, able to cut very fine grooves, about three mils (three thousandths of an inch) wide.

5 CHECKING THE RESULTS of his exacting work, Clair Krepps, M-G-M's technical director, compares the sound of a test pressing from a master disk with that of the master tape.

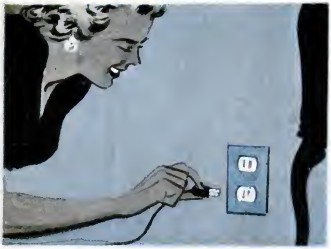
The cutting stylus, mounted over the turntable, is a specially ground sapphire. Its tip has a radius of one-quarter mil.

When a record is being cut, the stylus moves across the face of the disk at a rate determined by the variable-pitch control. This control, which the operator works by hand, governs the number of grooves the stylus cuts per lateral inch.

[*Continued on page 266*]

I'd Like to see them make...

EDIBLE TRANSPARENT TAPE for binding thick sandwiches together to keep contents in, and for closing up a turkey after it has been stuffed. —*J. Leporati, Long Island City, N.Y.*



LUMINOUS ELECTRICAL PLUGS and receptacles. With luminous paint around tips and holes, you could plug in appliances more easily in dark corners.—*Gene Malsch, Lake Bluff, Ill.*

SPRAY-ON WEATHER STRIPPING that could be squirted on in fall, stripped off in spring. The stuff used to "cocoon" stored aircraft might do. —*Mrs. E. E. Vassey Jr., Spokane.*

TRICYCLES WITH ADJUSTABLE PEDALS. Adding holes to the arms would let you move the pedals up or down to suit length of child's legs.—*Joe LaRiccia Jr., Montclair, N.J.*

A FIN ON OUTBOARD MOTORS, set behind the prop. Then you could steer the boat to the dock when you've cut the engine but still have headway.—*Fred Waldron, Concord, N.H.*

Everyone has his own pet idea of a gadget that he would like to see in general use. The five ideas illustrated above were suggested by POPULAR SCIENCE MONTHLY readers. What is *yours?* We will pay $5 for each one published. Please use Government postcards only. Write name and address clearly. Contributions cannot be acknowledged or returned.

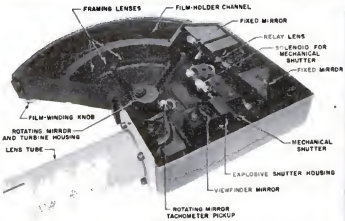
Odd Racing Yacht Designed By Physicist

THE strange plywood sailboat at the right, looking like a floating helicopter, was designed by an English physicist and yachtsman. It has a diminutive cockpit, rotating booms of a light alloy for its 260 square feet of canvas, and a 20-foot mast of the same metal.

British Spud Picker Scoops Dirt and All

LIFTING five tons of soil a minute as it moves through potato fields, this new British harvester runs the spuds gently through rubber "fingers" and separates them from the dirt in which they grew. The machine harvests four acres of potatoes a day.

Fastest Camera Now Speeded Up to 15,000,000 Frames a Second



THE famous high-speed camera revealed in 1952 by the University of California's Los Alamos Scientific Laboratory has now far outdone its original fantastic pace. Two years ago, it took 3,500,000 frames a second. Now, in an improved model, shown inside and out above and at right, it takes 15,000,000 frames a second on standard high-speed 35-mm. film. It is used to study the phenomena of explosions.

'55 Pontiac Is New

With a tricky V-8 buzzing under her bonnet and a flashy fall get-up to match, you'd hardly recognize the old girl.

All Over

By Devon Francis

FIRST PONTIAC V-8 in 23 years is quite a contrast to the last V-8, pictured below it. Replaced by a straight eight a year later, 1932 car had 83 horsepower, an engine displacement of 251 cu. in. It sold for $945. Pontiac for '55 has 180 horsepower, displacement of 287 cu. in. New hard-top, with all the extras included, costs more than $3,000.

AT THE Pontiac automobile factory some miles north of Detroit they are fond of passing around a picture showing a brace of paper cups full of water resting on the open door to the glove compartment in the 1955 edition of the car. The inference is clear—this vehicle rides so smoothly that the water won't spill.

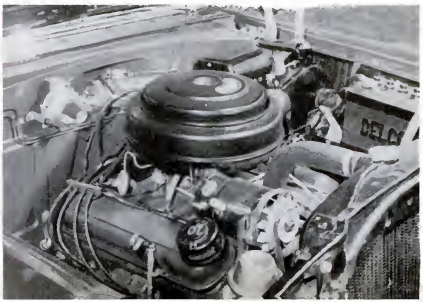
That's not quite true. The riding qualities of the new car, announced to the public late last month, aren't that good. But they almost are.

The suspension is new. So is everything else in this car for the new model year. The transformation in Pontiac hasn't been matched, for completeness, since 1935, when the company reintroduced their six-cylinder job after a hiatus of three years.

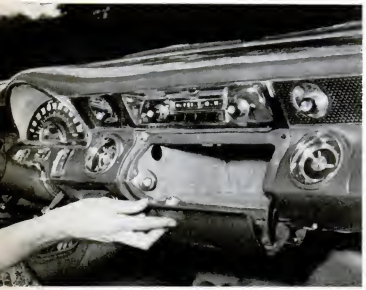
Low-Down and Fancy

Partisans of the Pontiac—and this belligerently loyal tribe is numbered in the millions—will hardly recognize the old girl in Main Street showrooms. She's lower and, interestingly enough, a wee bit narrower. In the Star Chief, one of the two lines, she's shorter, too. The windshield wraps around. On the fancier models the bodies are two-toned below the window sills. And under the hood is a spanking new engine. Like most new engines introduced

OVER-SQUARE ENGINE, with overhead valves in contrast to yesteryear's L-head power plant, has hydraulic valve lifters.



LOWERED ROOF, like those on all recent cars, makes the tall fellows duck cautiously to get in. This six-foot-three chap has 5½ inches of head showing above drip molding.



BRAND-NEW PANEL features a centered glove compartment. Hood line is down 3¾ inches for better driver visibility. Recirculating-ball type steering helps cushion road shocks.

SILVER STREAKS, almost as familiar a Pontiac trademark as its Indian, serve as rear fender moldings. Two-tone bodies are optional. For stability, rear springs are set outside frame.

these days, it's an overhead-valve V-8. It looks conventional. It is, almost. Yet the designers have introduced a couple of tricks that may be copied in other automotive quarters within the next year or two.

One of them is a reverse-flow cooling system. The water comes from the radiator through the top of the engine, past the valves, before it enters the block to cool the cylinders. There is a good and simple reason for this. The hottest parts of an internal-combustion engine are the exhaust valves and their ports. Fifty years of metallurgy have gone into the improvement of valves in gasoline engines to prevent warp, wear and loss of compression. The problem became so acute in aircraft engines that sodium-cooling was resorted to.

Cool Water Means Longer Valve Life

By bringing water at its lowest temperature, fresh from the radiator, directly to the valves, the Pontiac people think they have hit on a way to assure longer valve life, better gas mileage and, for the owner, fewer trips to the repair shop to mend the damage caused by burns in cylinder heads.

Even the crankcase-ventilation system is designed to keep the valves cool. The air circulates over the valves and the timing-chain cover and then washes down around the pistons.

A second trick in designing the new engine was to do away completely with the valve rocker-arm shaft. The arms teeter-totter under the thrust of the push rods and valve springs on studs that grow out of the cylinder head. The reasoning behind this was that separate mountings would minimize the ills of sidewise cocking and binding that OHV engines are prey to. This should reduce valve-stem wear and, in passing, make the valve system easier to service.

Old Engine Was Outdated

Pontiac will be bragging about the new 180-horsepower engine for months to come. They should. It was overdue. While overhead-valve V-8's were pop-

ping up these last few years all over the automobile world like mushrooms after a rain, Pontiac worried along with its outdated (and let's be fair, rugged, too) L-head straight eight. In some of its versions, notably that of two years ago, you had to lash the Pontiac Eight with a buggy whip to get it past a filling station. The engine was beginning to rebel against increases in compression, and pulling even a modest 127 horsepower out of it took a tidy bit of engineering wizardry.

Now the old engine is a memory. The new one, the first V-8 in this automobile in 23 years, leaves the owner with nothing to be ashamed of on getaway and passing ability at today's smart turnpike speeds.

Acceleration Figures Are 'Way Up

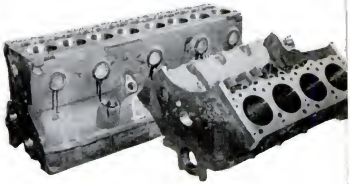
This is how the comparative accelerations, old and new, stack up:

	'54	'55
0 to 40.....(seconds)	7.5	6.3
0 to 60.....(seconds)	16.8	12.8

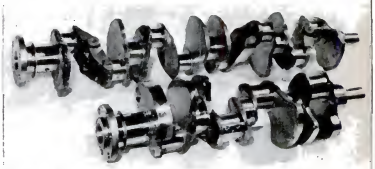
There is another fine point about this new engine that can be gleaned from what Pontiac, with refreshing candor, refers to as the "brag book," a rose-tinted engineering evaluation of the 1955 car. That's the peak torque. Torque, the thing that puts push in the rear wheels at the critical moment, can be moved around, within limits, to peak at various

[Continued on page 252]

SKIRTED PISTONS replace box type (in front). Oil ring has been moved from bottom to groove just below compression rings in top. Inside diameters of con rod bearings are up ¼ inch.



OLD BLOCK (in rear) was 33⅛ inches long and 11¾ inches wide. New one, with a bore almost a half-inch bigger, is only 22 inches long but is just shy of being seven inches wider.



HUSKIER CRANKSHAFT (front) in new car is only 25¾ inches long. The old one measured 38 inches. Slight overlap to throws and main bearings stiffens the shaft and prevents whip.

FACTS ON '55 PONTIAC

Model: Star Chief Custom Catalina.

Engine: 90° OHV V-8; 180 hp. at 4,600 r.p.m.; compression ratio, 8:1; piston displacement, 287 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,223; bore and stroke, 3¾" by 3¼"; crankshaft bearing surface, 41.5 sq. in.; torque, 264 lb.-ft. at 2,400 r.p.m.

Weight: 3,804 lb.; per hp., 21.1 lb.

Transmission: Hydra-Matic (optional); rear-axle, 3.08:1.

Steering ratio: 25:1; radius of turning circle, 21' 3".

Effective brake-lining area: 179 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 60½"; overall length with bumpers and guards, 210¼"; width, 75½"; wheelbase, 124"; overhang, front 32¾", rear 53½"; tread, front 58½", rear 59".

Inside dimensions: seat-cushion width, front 61½", rear 64¼"; leg room, front 42½", rear 37½"; headroom, front 34½", rear 34"; seat height, front 13½", rear 12"; vertical distance, steering wheel to seat cushion, with seat in mid-position, 5.1"; front-seat adjustment, horizontal 4.4", vertical ½".

Tire size: 7.10 by 15.

Price: About $2,900 with automatic transmission, power steering, power brakes; taxes and freight extra.

Truck's Vacuum Fan Cleans Out Ash Bin

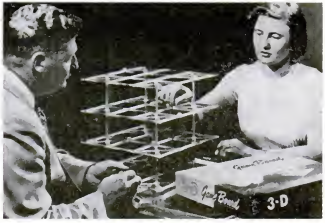
THE machine has taken over another of man's messy chores: hauling out the ashes. This truck, shown in action in Brattleboro, Vt., backs up to a house, its driver connects hoses to basement tube terminals, and a vacuum fan in the truck, running off the engine, inhales the ashes.

Door-Jamb Guards Protect Fingers

FOLDED strips of a Bakelite plastic (above), anchored with metal molding to a door and its frame on each side of the dangerous hinged edge (left), protect children's carelessly straying fingers —and grownups', too. The door-jamb covers, colored aluminum gray, are made by the Stanley Works, 195 Lake St., New Britain, Conn. They come in various widths and are designed to be installed on practically any door of wood, metal or glass, whether hung on hinges or on pivots.

AA Gun Has Two Miles of Wire

THE woman worker above is checking the 2,800 electrical connections, involving two miles of wire of 40 different sizes, in the fire-control system of the uncanny U.S. anti-aircraft gun called the Skysweeper. Radar and an electronic computer aim it.



Ticktacktoe Adds a 3-D Touch

THAT fascinating old time-killer, Ticktacktoe, has taken on a third dimension with the introduction of Four Straight, a version of the game that is played on four levels of clear plastic (above). Tedco, Inc., 5201 Cameron Rd., Austin, Tex., makes it.

V-8 Gives Chevrolet 162 Horsepower

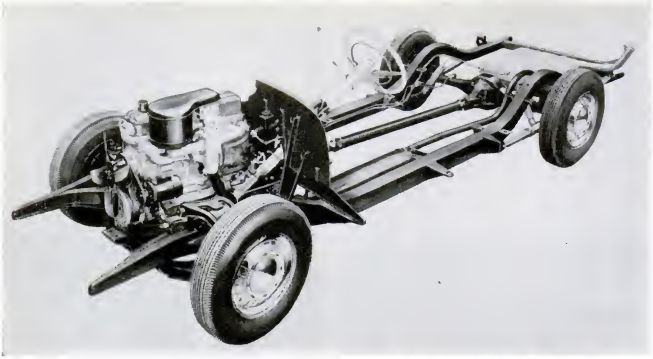
Sixes get a boost, too, as striking changes in body design give the 1955 models a big-car look to go with their power.

WITH its first V-8 engine in 35 years and an impressive big-car look, the 1955 Chevrolet made a dashing entrance onto the automotive stage the last week in October.

The new valve-in-head V-8 puts out a blistering 162 horsepower, 37 horses more than Chevrolet's huskiest six of 1954 could muster. The car it drives comes equipped, for the first time, with tubeless tires and a 12-volt battery. Even air conditioning is available for the V-8 line.

An obviously lower silhouette—the sedan is 2½ inches closer to the ground than before, the station wagon as much as six—makes the new Chevrolet look longer, although the wheelbase is un-

RED WARNING LIGHTS have replaced the ammeter and oil gauge on the new Chevvy instrument panel. On Powerglide models, the quadrant is mounted just below speedometer.



RUGGED, RECTANGULAR FRAME of the 1955 Chevrolet is said to be 50 percent more resistant to twisting than the 1954 version, though 18 percent lighter. A six-cylinder engine, with side-mounted air cleaner, is shown above.

changed for 1955—it's still 115 inches.

There are certain GM family traits in the features of the '55 Chevvy—the tapered doors that made their debut on the first Buick Skylark (PSM, Oct. '52, p. 100), the vertical windshield pillars, wrap-around windshields and high, straight fender crowns that became familiar sights on recent Buicks and Oldsmobiles. Its hooded headlights are an inheritance from various GM dream cars of the past two years. Then there is a hint of its own Chevrolet forebears in the neat, small, rectangular radiator grille, strongly reminiscent of the first Corvette's (PSM, Mar. '53, p. 166).

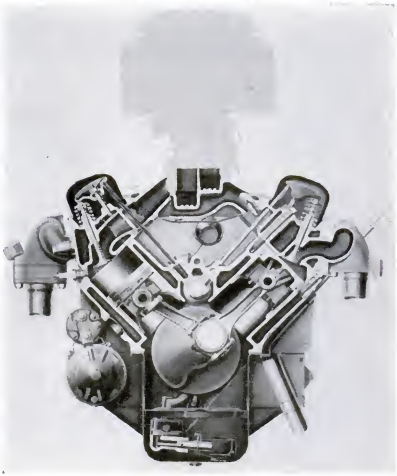
Hot—and Can Be Even Hotter

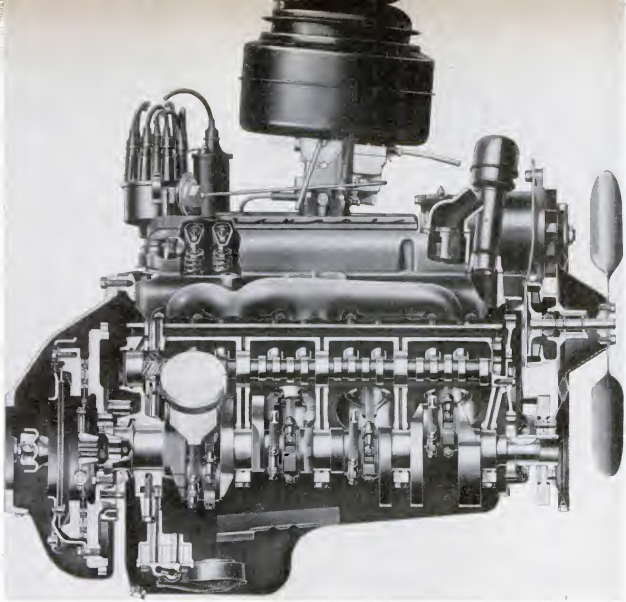
The compact new Chevrolet V-8 engine, called the Turbo-Fire, has a compression ratio of 8 to 1, as opposed to the 7.5-to-1 ratio in both 1954 sixes. Its displacement is 265 cubic inches, up 30 over that of this year's engines. It has a bore of 3.75 inches and a stroke of 3 inches, shortest in the industry.

For the restless owner who is not wholly satisfied with his V-8's innate 162 horsepower, there is available a package deal, consisting of a four-barrel carburetor and dual-exhaust system, that will boost the horsepower to 180!

In addition to the V-8, Chevrolet con-

CROSS SECTION of new V-8 shows the innards of a type of engine with which Chevrolet has experimented since 1917-19, though this model was basically redesigned within the past three years. It combines a very short stroke with a bore unusually large for engine's length.



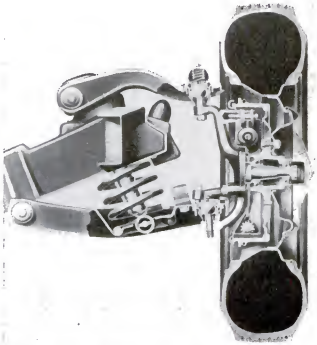


UNUSUAL COMPACTNESS of the 162-horsepower V-8 engine is evident in this cutaway drawing of its working parts. The carburetor is of two-barrel design and has an automatic choke.

tinues to offer two sixes. Both have had their power boosted for 1955 competition. The six-cylinder engine that comes with conventional gearshift now has 123 horsepower, an increase of eight over the 1954 figure. The six built to go with Chevvy's Powerglide automatic transmission has been upped to 136 horsepower, 11 better than last year's output.

For the first time, on request, Chevrolet will install overdrive, which automatically cuts in above 31 miles an hour when the driver takes his foot off the accelerator.

As a natural result of providing what Chevrolet calls a "sweep-sight" windshield, front-seat visibility in the 1955 cars has been increased—by 19 percent. In the four-door sedans, with every window larger than ever, there is now 24.5 square feet of glass area. END



NEW FRONT SUSPENSION cancels most of the "dive" in sudden stops. This cutaway shows how coil spring of knee action nests into frame.

Robots Turn Out Printed-Circuit Television Sets

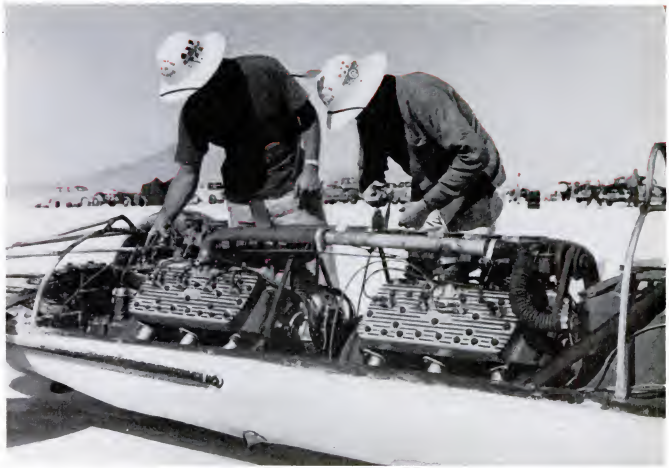
IN SECONDS, the automatic production line at left assembles half a TV receiver's chassis—the circuit board the girl is showing, bottom and top, in the foreground. The cost-lowering method makes possible a $150 set with 21-inch picture tube and 18-tube chassis. Used by Admiral for two new vertical-chassis table models, it is based on a printed circuit. From a drawing of the circuit, below, a

camera produces a negative. Photo-etching reproduces the pattern on metallized-plastic circuit boards. Then each board passes down the assembly line, where high-speed robot machines insert 50 resistors and wire jumpers. Final hand work requires more employees than before, to keep up with the robots.

Callers See Each Other on TV Phone Introduced for Business Use

TV PHONES can now identify bank and department-store customers and their signatures, and interview visitors seeking admittance at plant gates. At each end a screen shows both parties (right), or its full width may be used for documents, in a commercial system introduced by Kay Lab, San Diego, Calif.

Two-Engine Hot Rods Drive for 300 M.P.H.



Souped-up twin power plants in specially designed bodies edge closer to dazzling goal.

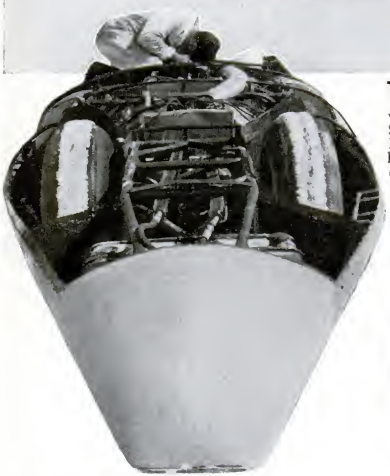
AMERICA'S most free-wheeling automobile designers, the back-yard mechanics who build racing hot rods, have launched their grand assault on a fantastic speed mark. Their goal: 300 miles an hour. Their weapon: two engines in one chassis. This fall at the annual National Speed Trials on the glistening 11-mile salt flats at Bonneville, Utah, six twin-engine streamliners, shown here and on the next two pages, roared at peak power toward the goal. One of them, Chet Herbert's twin-Dodge hot rod, came close. It unofficially passed 260 miles an hour when the timing lights failed. Two watchers clocked it at 270.

Mercs End-to-End on a '39 Ford chassis powered this entry belonging to Bob Moll, a meat salesman, and Melvin Hales, a building contractor. Moll owns the front engine (12:1 compression ratio), Hales . . .

. . . the rear (10:1 compression ratio). The glass-fiber body (above) weighs only 200 pounds, can be installed in two minutes. The entire car . . .

. . . which set a new record of 183.63 m.p.h. for the two-way run, weighs 2,300 pounds. Lap belt, roll bar and helmet protect the driver.

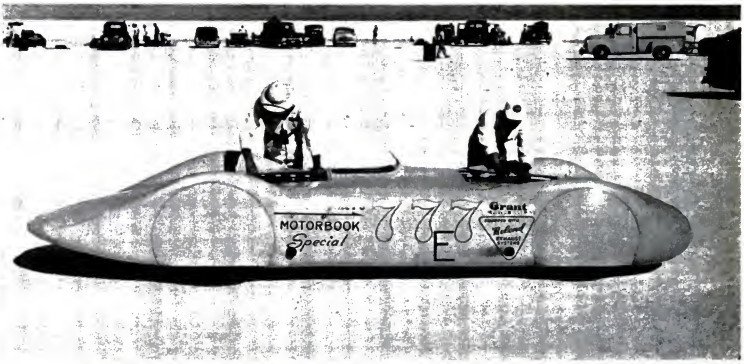
Twin Dodge V-8s drove Beast No. 5, Chet Herbert's spectacular performer, which unofficially exceeded 260 m.p.h. The engines of the 2,500-pound car are not hooked together. A cable throttle connection controls fuel flow to them.



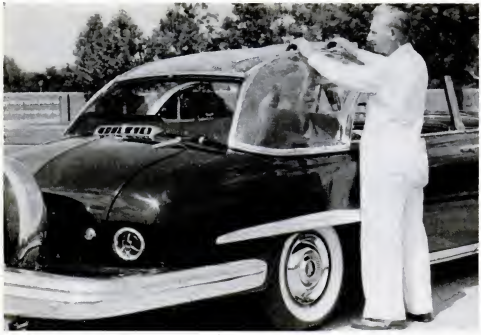
Two Chryslers souped up to pour 900 horsepower to all wheels of this reptilian racer, the Le Blanc Special, made it one of the hottest cars at Bonneville. With body removed (left), it looked like intricate bridgework. Driver (below) lay nearly on his back.

Modified '32 Ford coupe packed a pair of stock Chrysler V-8s. Running on pure alky, they develop 650 hp. at 5,200 r.p.m. Engines, at front and rear, are linked by a shaft housed in the torque tube.

Twin Mercs drove Mickey Thompson's $7,000 coupe, which weighs only 2,480 pounds. The engines are connected by a chain coupler. The front engine kicks out 310 hp., the rear engine 285 hp., at 5,300 r.p.m.



Two Ford V-8s with four-wheel drive sent the Kenz-Leslie streamliner through timing traps at 256 m.p.h. one way. Each engine operates independently through push-pull rods from a single throttle. Two airfoils help keep rear end down. END



Ike's Car Lets You See Him Through Roof

EVEN when it rains, crowds waiting to see the President ride by can get a good view of him through this plastic shelter. Suggested by Ike himself, the knockdown roof fits inside the trunk of the parade car when it is not in use. A new interior light illumines the Lincoln at night.

Britain Tries Out Midget Jet

THIS bantamweight jet fighter is the Folland Midge, one of the world's smallest fighters. It is said to have low engine power, but it boasts a speed of more than 600 miles an hour. A British experimental aircraft, it carries no armament as yet.

Portable Incubator Paces Stork

THESE ambulance attendants are loading a portable incubator, on a litter, aboard to rush it to a premature baby born away from the hospital. It has a heating and humidifying element that plugs into any electric outlet. An oxygen tank goes with it.

They Say Now.....

JOHN V. SIGFORD, GUIDED-MISSILE ENGINEER: *"Supersonic speeds and extremely high altitudes have put man in such an unnatural environment that he no longer is able to cope with the problems."*

CRAWFORD H. GREENEWALT, PRESIDENT, DU PONT CO.: *"In the 50 years during which we have practiced applied science . . . we have made only the smallest of forward strides, and the horizons before us are unlimited . . ."*

LEWIS L. STRAUSS, CHAIRMAN, U. S. ATOMIC ENERGY COMMISSION: *"We are not yet at high noon of the atomic age—only at the first glimmer of its dawning."*

DR. E. D. ADRIAN, PRESIDENT, THE ROYAL SOCIETY: *"The human race cannot stand more than a few thousand large atomic explosions whether they hit the target or miss."*

DR. MONT A. CAZIER, CURATOR, DEPT. OF INSECTS AND SPIDERS, AMERICAN MUSEUM OF NATURAL HISTORY: *"We have great difficulty living with the insects, but at the same time we cannot do without them."*

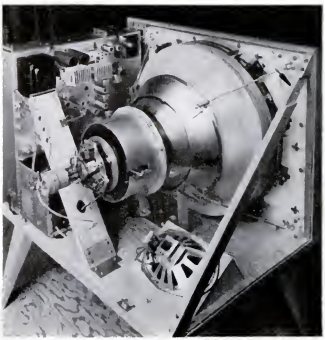
BLACK-AND-WHITE SET? No, this compact cabinet with the 21-inch picture is a new RCA color receiver. White line indicates size of the 15-inch screen used in last year's color models.

New Color TV Is Bigger and Cheaper

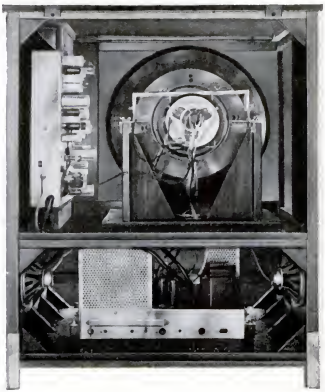
THE new color-television sets look like television sets at last, instead of brilliant peepholes in huge boxes. The pictures are big—19 or 21 inches. The cabinets are small, some no larger than those on equivalent black-and-white receivers. And prices are down a bit: under $900, with a drop to $500 forecast. The color they reproduce is excellent, in the opinion of observers at recent press showings. A few of these new models are in the stores now, but the most radically changed sets won't be available until '55.

The networks have scheduled 100 hours of color shows for this season. These will be special "prestige" productions and color versions of the most popular regular programs.

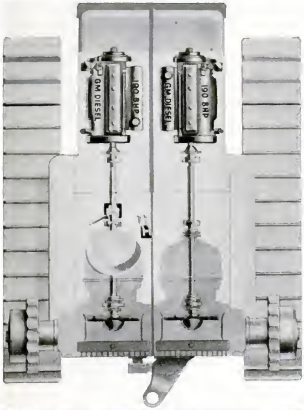
SIMPLIFIED COLOR CIRCUIT takes little space, contains 28 tubes, draws but 300 watts. It's scheduled for future production at RCA.



CONSOLE WITH TWIN SPEAKERS, in production at CBS-Columbia, has 19-inch screen. Set with 21-inch rectangular picture tube is in works.



New Twin-Diesel Tractor Has 380-Horsepower Push



THE eight-m.p.h. top speed of this 26-ton beast won't win speed laurels, but its two 190-horse diesels are leading in the horsepower race—it has, its maker says, twice the power of current big tractors. Twenty such experimental crawlers are being made by GM's Euclid division for road building, open-pit mining, and logging. Each engine drives a single track; you can steer with throttles, transmissions or brakes. Hinged radiators are out in back, so's not to heat up the driver.

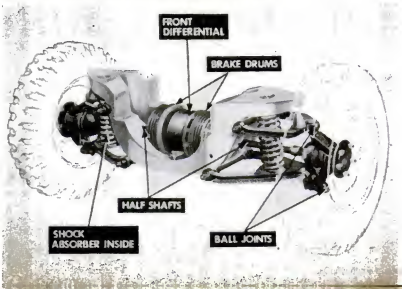
BELGIAN BLOCKS AT 50 M.P.H., pure murder in the older vehicle, are just a mild massage in new one. Its wheels do far less hopping.

Fast New

NO LONGER the chiropractor's delight, the Army's quarter-ton utility vehicle threatens to become as smooth-riding, and nearly as peppy, as a '55 sedan.

That is the prospect suggested by a handful of experimental vehicles built for the Ordnance Corps by Ford. (In redesigning the jeep, Ford ducked the name problem—"jeep" belongs to Willys—by drably christening its vehicle the "XM-151." For simplicity could we call it the "Forp?" No? How about "Feep?")

FRONT END, hung on a sturdy steel pressing, can be unbuttoned fast as a unit, or disassembled in bits. Vehicle has had elaborate stress analysis plus much hard testing.



OLD AND NEW look superficially alike, though the "Feep" (right) is slightly lower, with shorter body on longer wheelbase. Note difference in front suspensions. Reduced weight, achieved in part by integral frame and new suspension, permits easier air drops.

"Feep" Even Rides Well

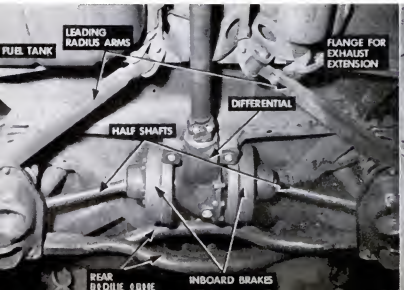
The Feep weighs 2,140 pounds, almost 600 less than the current job, despite a four-inch increase in wheelbase and a complete absence of aluminum or magnesium alloys. Height is down five inches but ground clearance is slightly increased; over-all length is 7.3 inches less, but cargo space is 26 percent more; power is up slightly (to 71 hp.) but cruising range is 30 percent greater. A four-cylinder overhead-valve engine makes it go.

The new vehicle has an integral, welded frame-and-body. All wheels are independently suspended on coil springs, with inboard brakes snugged up to the differentials. There's a high degree of parts interchangeability—front and rear brakes and differentials can be swapped.

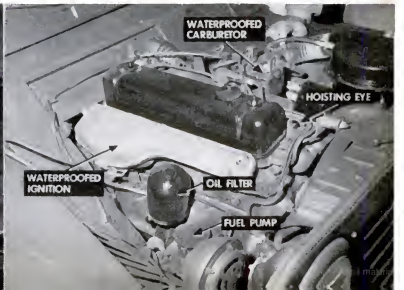
Servicing is simplified. The entire front suspension can be pulled and replaced in about half an hour, and engines can be switched in less time.

Old jeep pilots will feel at home: transfer-case gears still give off that keening banshee cry.—*Frank Rowsome Jr.*

BACK END from underneath shows control arms that locate rear wheels. Rear arms look as if they'd clash with one wheel up and other down, but there is actually ample clearance.



STICK A SNORKEL on the air intake, an extension on the exhaust and a plug in the transmission breather, and the Feep is ready to cross rivers right on the bottom.



Truck Gets a Lift to the Job

On the roof of the New York Telephone Co. building in Buffalo was heaped a lot of debris from construction work there. To cart it away, workmen simply hoisted a truck six stories to the roof, loaded it and then lowered it to the street.

Super Radar Tube Is Unveiled

A vast extension of the scanning range of radar is expected in the near future as a result of the development of this eight-foot, 4,000,000-watt microwave tube. Made by Sperry Gyroscope Co., the giant tube is already in quantity production.

Explosive Cord Takes the Backache out of Posthole-Digging

College fellers at Stanford Research Institute's Poulter Laboratories have found a way to relieve the farmer's aching back when postholes must be dug.

First he drills a one-inch pilot hole with an auger (left), as deep as the auger allows. Then (center) he lowers several strands of primacord, which looks like oiled sash but contains a core of high explosive, into the hole. An electric blasting cap sets off the charge. The resulting hole (right) is clean and ready for the post.

WITHOUT LEAVING THE TABLE in her kitchen, Mrs. Blakeslee can regulate the room's lights and heat, sprinkle the back lawn, control the radio in the den or talk with any other room in the house. Her ingenious husband is seen at right in the front hall.

It's a soft life for this family in a

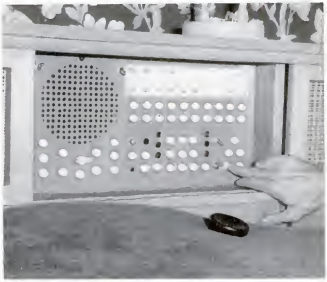
"Push-Button Paradise"

Most household chores are under fingertip control in the Ted Blakeslees' magical Los Angeles home.

By Andrew R. Boone

BECAUSE it once pained him to have to climb out of a sickbed to turn off a yawping radio, Ted Blakeslee has converted his Los Angeles home into a push-button paradise.

With the aid of 175 push buttons, 101 relays, 10,600 feet of wiring and an absolute minimum of effort, the Blakeslee family can select radio programs, change phonograph records, regulate the heat, adjust an awning, open and close the garage doors, water a plant, start the car, sprinkle the lawn and edge it, find out who's at the front door and let him in if they choose, telephone to the folks across the street without charge, and



WITHOUT STIRRING FROM BED, the Blakeslees can make sure that the doors are locked, the lights out and the furnace set for the night. That earphone is for solitary radio-listening.

ONLY A DOG CAN HEAR when Blakeslee whistles at his garage door. The high-frequency sound, beyond human hearing, starts a motor to open the door in five seconds, close it in 15.

THIS PLANT WON'T DIE of neglect, for when the lawn sprinklers go on, set off by a timer, a trickle of water simultaneously flows to the base of the plant through a tiny tube.

IF THE LAWN NEEDS EDGING along the front walk, a push on a button in the house causes this resistance wire—the same as used in an electric heater—to get red hot and do the job.

turn the lights on or off in the house.

It cost Blakeslee less than $250 but 10 years of part-time work to turn his home into an electronic house of magic. As a Fellow of the American Institute of Electrical Engineers and director of electrical operations for the Los Angeles Dept. of Water and Power, he had the necessary know-how to begin with. The requisite equipment was bought in war-surplus stores, salvaged from discarded material in his own shops or, in the case of certain lengths of wire and cable, given to him by fascinated friends.

When a caller at the Blakeslees' pushes the front doorbell, chimes indoors sound once. After a five-second pause, they sound three times more, of their own accord. If this hullabaloo doesn't rouse the residents, it won't do

THE FAMILY VIOLINIST, Lynn Blakeslee, keeps a running account of her progress by making tape recordings in the den. Buttons inside the phonograph cabinet control it and the radio, pipe sound to five speakers elsewhere. Lynn's doll house (right) is also under fingertip control.

the bell pusher a bit of good to push again. A lockout relay by then has silenced the chimes.

If the Blakeslees are at home and not deliberately lying low, the first chime will usually prod one of them to ask "Who is it?" through a speaker-microphone in the ceiling of the porch. Since the communications system is two-way, the caller can reply simply by talking at the ceiling. If he is somebody the Blakeslees really want to see, they'll push a button that unlocks the door.

His Garage Listens for Whistles

Pushing buttons in the front hall also sends the garage doors up or down, but Blakeslee had to work out a different system for opening the garage when he was approaching it in his car. He could have used radio control, but he chose instead to use sound—one of those whistles that dogs can hear but humans can't. Its high-frequency screech hit a microphone, the sound was amplified and a circuit relay got the word, which it passed on to a small electric motor.

This was a satisfactory arrangement until, on four separate occasions, the garage doors shot up when (a) a neighbor celebrating New Year's set off a siren, (b) a truck's brakes squealed, (c) the revolving steel bristles of a street-sweeper made a sound beyond human hearing, and (d) a dog howled.

Blakeslee solved this problem by installing a time-delay in the circuit relay. Now he blows his whistle twice, with five seconds between blasts. END

PLUNGING HOOD LINE on the '54 Studebaker Commander, far left, is interrupted on the new President next to it by a fresh grille treatment. Tubeless tires are standard.

Wilbur Shaw, the Indianapolis Speedway's boss, tries out

Studebaker's New

Extra horses turn the sleek, economical '55 Studey into a red-hot, rarin'-to-go road car.

SOMEHOW, it's something that you would not expect from Studebaker. Advanced styling, yes. A fine automatic transmission, yes. Economy, yes—Studebaker swept the field in the Mobilgas Economy Run this year. But horsepower—that's a steed, as it were, of a different color.

Yet conservative Studebaker has done it. For the moment, anyway, pending returns from the rest of the '55 cars, Studebaker's new President has more power-for-weight than any other U.S. automobile except Chrysler's New Yorker Deluxe.

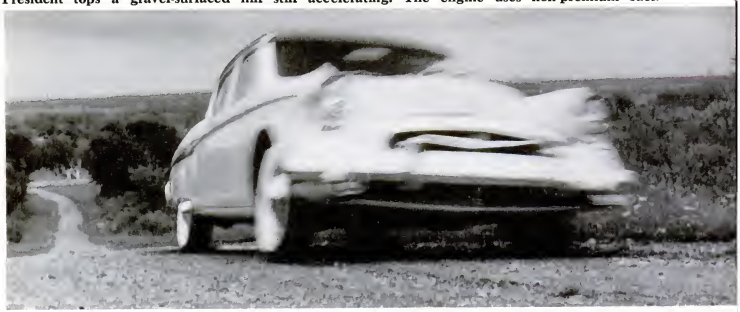
It's reflected in the performance, too. For 1954 the company's top car, the Land Cruiser, required 866 feet to pull out around a car ahead of it doing a steady 50 miles an hour, pass and get back in the proper lane. The President will do the same job in 100 feet less.

Light Weight Means Extra Punch

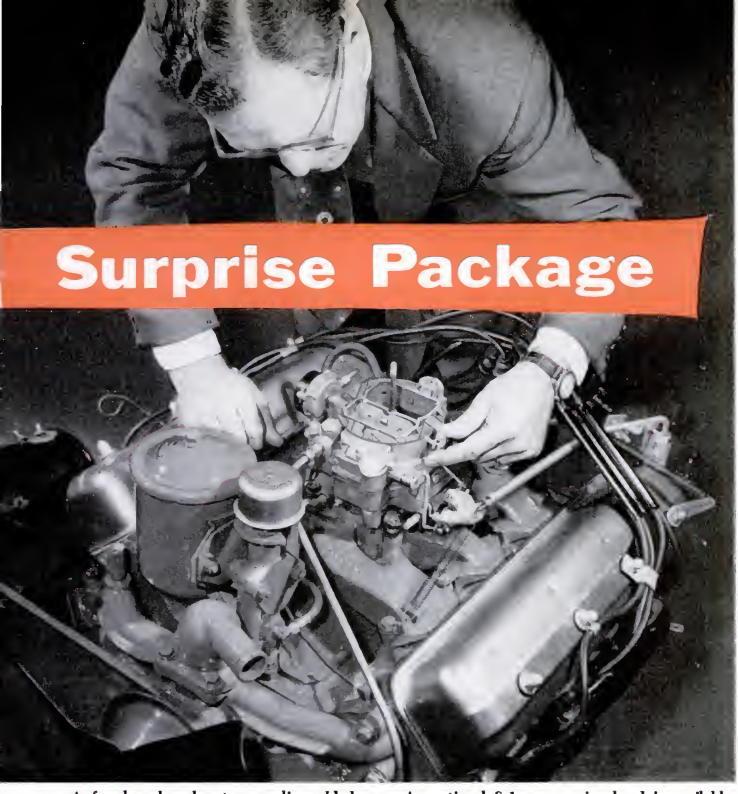
As horsepowers go these days, the President's is fairly modest—175. It's the relatively light car weight, in this biggest of the new crop of Studebakers, that gives it the weight/horsepower advantage. At 3,219 pounds curb weight, the President is hundreds of pounds lighter than most cars of similar power. And, as everyone knows, it's the ratio of power to weight that separates the pistols from the peashooters when the light turns.

That's not all that I found out about the company's 1955 cars on a visit to

President tops a gravel-surfaced hill still accelerating. The engine uses non-premium fuel.



Surprise Package



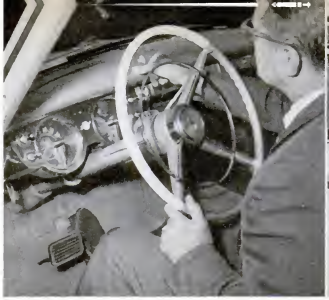
A four-barrel carburetor supplies added sass. An optional 8:1 compression head is available.

the sylvan proving ground on the outskirts of South Bend late last August. The Commander, or middle, line of Studebakers will jump its horsepower with a *decrease* in piston displacement. And the little Champion, the car that won the economy run hands down, will also be up in power with no apparent sacrifice of savings at the gas pump.

The Studebaker story for '55 comes right off the engineers' drafting boards and out of the laboratories. The story is engines.

The President, a line revived for the first time since World War II, is of course the centerpiece of the company's show for the new year. It deserves the rank. Only two cars currently surpass it in horsepower per cubic inch of piston displacement—the two Chryslers and the Cadillac. It's right among the best of them, too, in low piston travel per mile. That means little engine wear.

How the car shot up from 127 to 175 horsepower—a 38 percent boost—without a new V-8 block and without raising the



NEW INSTRUMENT PANEL is surmounted by a padded, glareproof shelf. Studebaker is one of only two cars (the other: Packard) offering lockup type of torque-converter transmission.

HEAVY CHROME MOLDING and the "President" designation on the side distinguish the new line of cars. Name was last used by the company prior to our entry into World War II.

compression ratio is one of the pieces of legerdemain surrounding the industry's 1955 cars.

Bore-and-Stroke Ratio Is Changed

The engine has been just slightly oversquare—the bore was an eighth of an inch greater than the stroke. For 1955 the disparity between bore and stroke is greater—3 9/16 by 3¼ inches.

That's part of the answer. It used to be a rule in designing engines that you could get a lot less wear—better mechanical efficiency—by increasing the bore and shortening the stroke. But you would get less power out of your fuel; your thermal efficiency suffered.

The rule still holds good, but it has been modified. Today, with higher compressions, better fuels and overhead valves, the engineers are gaining more than they lose by expanding the bore and shortening the stroke.

There are contingent benefits in this. In a typical long-stroke engine each piston will cover 40-odd miles in its up-and-down cycle in the cylinder for every 100 miles of highway travel. In a typical short-stroke engine—that in the President, for instance—each piston will cover only 29 miles over the same distance.

When the stroke is shortened, the incoming air-gas charge and the outgoing burned gases have a good deal less velocity through the valve ports. That lengthens valve life and, incidentally, reduces engine noise.

[Continued on page 258]

FACTS ON '55 STUDEBAKER

Model: President 4-door sedan.

Engine: OHV V-8; 175 hp. at 4,500 r.p.m.; compression ratio, 7.5:1; piston displacement, 259.2 cu. in.; piston travel (in feet per car mile at 20 m.p.h.), 1,569 with standard transmission; bore and stroke, 3.56" by 3.25"; crankshaft bearing surface, 43.7 sq. in.; torque, 250 lb.-ft. at 3,000 r.p.m.

Weight: 3,219 lb.; per hp., 18.3 lb.

Transmission: 3-speed manual shift, overdrive or automatic drive optional; rear-axle ratio, standard, 3.92:1.

Steering ratio: 24:1; radius of turning circle, 20.5'.

Effective brake-lining area: 195.3 sq. in.

Springs: front, coil; rear, semi-elliptic.

Outside dimensions: height, 60"; overall length with bumpers and guards, 206¼"; width, 70 7/16"; wheelbase, 120½"; overhang, front 37¾", rear 48¾"; tread, front 56 11/16", rear 55 11/16".

Inside dimensions: seat-cushion width, front 59¾", rear 59"; leg room, front 42¼", rear 41"; headroom, front 36", rear 35"; seat height, front 13¾", rear 12½"; vertical distance, steering wheel to seat cushion, 5¾"; front-seat adjustment, horizontal 5¾", vertical 15/16".

Tire size: 7.10 by 15.

Price: $2,710.83 with automatic transmission, power brakes, power steering; taxes and freight extra.

Six-Well Oil Rig Digs In

Oil drillers can sink six three-mile-deep wells from this big rig without leaving its platform. Ordinary offshore rigs must be dismantled and toted by barge to each new location. Aboard this giant in the Gulf of Mexico, the crew moves the crown block, or pulleys, at the top, changes over the pipe rack, slides the drive mechanism on the floor to a new position and, 12 hours after finishing a well, is ready for another.

Table Model Is Hi-Fi

A column of 16 tiny vertical speakers, forming a half-cylinder on the front of Philco's new table-top hi-fi phonograph, diffuses the sound over a 180-degree pattern. This type of loudspeaker, new to table phonographs, is called "electrostatic."

Cartridge Fills Pen

This new C/F fountain pen, made by Waterman, has been weaned from the ink bottle. To fill it, you merely insert a cartridge in its barrel. When it runs dry, change cartridges. A supply of eight comes with the pen.

Tiny Cell—Big Job

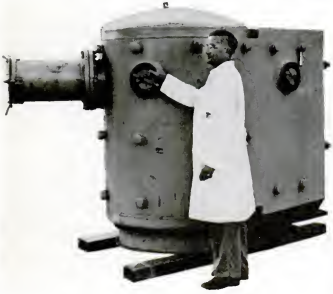
A peewee light- and heat-sensing cell of very great sensitivity, so small that 20 of them are on the three-quarter-inch piece of glass above, has been developed by Eastman Kodak. It can be used to control switches and chemical processes.

Most Ancient American Skull Is Rebuilt

FROM fossil bone fragments found by an amateur archaeologist near Midland, Tex., Dr. T. Dale Stewart (left) of the Smithsonian Institution has pieced together a male skull that he says is 12,000 to 20,000 years old—oldest yet found in the United States.

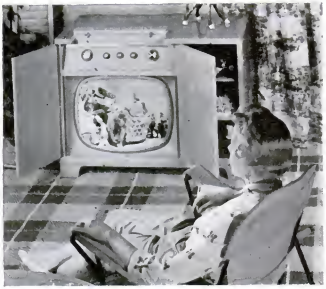
Big Air Compressors Now Travel by Train

THE Navy now owns two mobile air compressors, capable of supplying 3,000 cu. ft. of air per minute at a pressure of 125 pounds. Clark Bros. of Olean, N.Y., built them and installed them on a railroad car (right), in which they promptly rode to the rescue when a shipyard's regular compressors failed.



Cabin Duplicates Space Flight

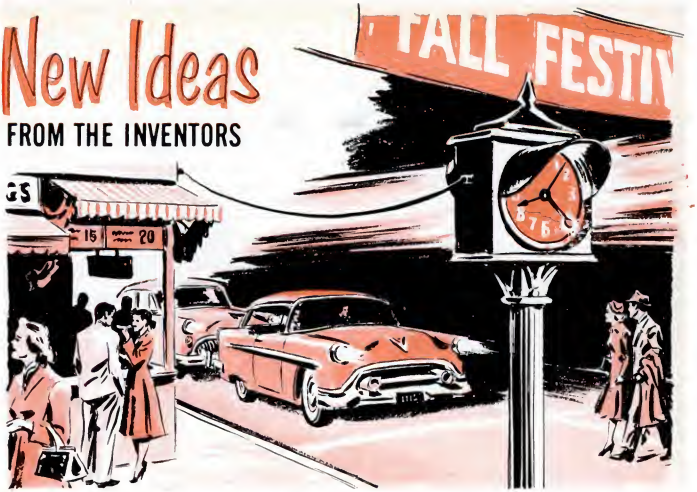
BEFORE the U.S. Air Force attempts to fly beyond the earth's atmosphere, it is going to find out what it's up against by "flights" in this sealed cabin at its School of Aviation Medicine. The cabin duplicates conditions of space travel.



New TV Set Lowers the Screen

Low enough to fit under many a picture window, a new General Electric TV model mounts its 21-inch screen near the floor—a natural viewing angle, the company points out. The controls are above the screen, on an upslanting panel.

New Ideas
FROM THE INVENTORS



1 Plug-in Traffic Light to Time Itself. This clock-faced portable signal might help police regulate extra-heavy traffic on roads that don't need full-time control. It could be plugged into any electric outlet. Timed by its own clock, it could be set for any interval or synchronized with other lights. It would have only a single face for each direction; green and red bulbs would light up behind the glass clock lens.

2 Molding to Keep Outlets Handy. A continuous electric outlet made in the form of decorative molding trim would let you plug in appliances where you want them. This molding, carrying two conductors, would be perforated along its face. Adapter plugs, made to fit the perforations, would take standard plugs.

3 Knife to Wash as It Peels. With this paring knife connected to the kitchen tap, a cook could skin vegetables faster and better. Running water squirted through a hose and along the blade would wash off the loose peelings. The inventor says it will also hose down the smelly particles that usually make onion peeling a tearful job.

Please turn the page for more new ideas

MORE New Ideas from the Inventors

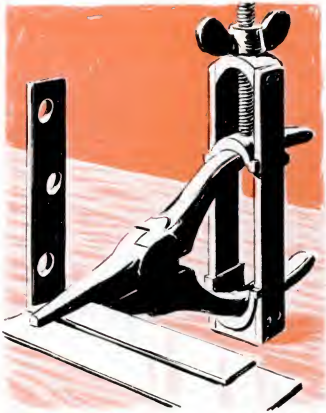
4 Shoe to Float You on Air. If your feet object to being walked on, they might find comfort in this air-cushioned sole. It would absorb a lot of pounding and road shock without greatly increasing a shoe's weight or bulk. An air pocket inserted between the separated upper and lower sole sections would provide the cushioning effect.

5 Case to Fit on Steering Wheel. Clipped to the spokes of a steering wheel, this utility attachment would keep cigarettes, notepaper, coins and other items within easy reach. Narrow-mouthed troughs fitted into a transparent plastic retaining disk would hold the objects and keep them from being dislodged by normal steering movement.

6 Roof Floats to Buoy Copters. Ordinary roofs have to be heavily—and expensively—reinforced before they can be used as helicopter fields because the points where the wheels come to rest must support loads of several thousand pounds a square foot. This inventor says, however, that any roof sturdy enough to hold a tank of water would serve. He'd float landing platforms on the water to distribute the weight.

U. S. patents on these inventions have been granted to: 1. A. Winn, Valdosta, Ga.; 2. R. K. Hensley Jr., Silver Spring, Md.; 3. F. R. Barbee, San Gabriel, Calif.; 4. W. Reed, Memphis, Tenn.; 5. F. Berman, Pewaukee, Wis.; 6. A. C. Thomson, Manhattan Beach, Calif.; 7. E. N. Jacobs, Louisville, Ky.; 8. J. Elsberg, NYC; 9. W. D. McIntyre, Monroe, Mich.

7 Electric Rack to Dry Towels. This bathroom fixture would end the nuisance of soggy towels even on the dampest days. It would also be handy for quick-drying small laundry. The rack would have an electric heating element and a fan built into one end. The fan would force warm air through the vented, hollow towel bars.



8 Plier Vise to Grip Small Parts. Mechanics who have tried to hold small parts in one hand and work on them with the other should appreciate this simple clamp. It would turn almost any pair of pliers or pincers into a small-parts vise. The plier yoke could be screw-fastened to a work surface or gripped in another vise.

9 Escape Reel to Brake Itself. This portable fire escape would let its passenger down without the terrifying acceleration of an ordinary rope drop. As the coiled steel tape played out of the top of the descending reel, the weight of the rider would increase the braking pressure enough to level off the rate of his fall.

Will Rubber Hubs Improve Your Ride?

RUBBER SLEEVES, between spindle and tire rim, can be soft enough to indent with finger pressure. This is because load is distributed around entire circumference, not just in limited areas. Calculations for the rubber hub were worked out by Dr. M. A. Müller, the mathematician who developed formulas for the Heinkel jet bomber in 1939. Sprung wheels now weigh about a fifth more than conventional ones, but use of light metal alloys may cut this. Tests so far show no predictable limit to the life of the rubber, which is expected to last as long as the vehicle will.

New cushioned disks for cars and motorcycles soften bumps, reduce spinning and skidding.

By Harry Walton

TAKE a slice of well-seasoned tree trunk, true up the outside, mount a soft balloon tire and roller bearings, and you have a fair facsimile of the modern auto wheel. Basically it is still the wheel that some prehistoric genius invented 5,000 years ago—a rigid disk.

What could be better?

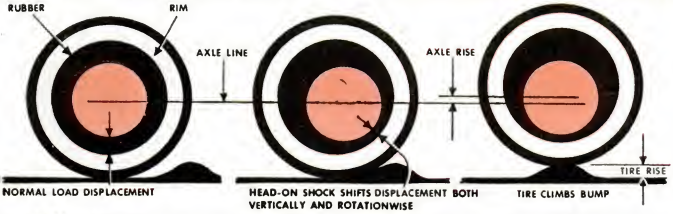
A nonrigid wheel, which would help absorb road shock, prevent tire bounce, cut down on skidding, and almost eliminate tire spin would certainly be better.

A wheel reported to do all this, the first major improvement since the ancient Egyptians discovered spokes, has been invented by a German, Albrecht-Wolf Mantzel of Frankfurt. Instead of rigid spokes or a steel disk joining hub and rim, it has rubber rings or sleeves.

In this wheel, the rim and tire do not always run concentric with the hub. They "run out"—turn eccentrically—whenever the car hits a road bump, the brakes are applied, or you step on the gas. This run-out keeps shock from getting to the hub, and gives a new kind of ride that may outmode every car on the road today.

Outlawed for racing. Last year Rolf Goetze, German automobile-parts manufacturer and race-car enthusiast, put Mantzel's wheels on a Porsche racer.

What happens when a rubber wheel hits a bump



LIVE-RUBBER SECTION of new wheel translates first head-on shock of a road bump into rearward displacement of rim, instead of delivering a solid slam to the spring suspension. At the peak of the bump, rubber absorbs part of the upward displacement of the axle. This means that the conventional car springs need disperse only a smaller and gentler axle movement.

He won a Nurburgring event with it, although the car was smaller and less powerful than some racing against it.

European racing authorities promptly outlawed the wheel because it was not available to all drivers and its advantages made it unfair competition.

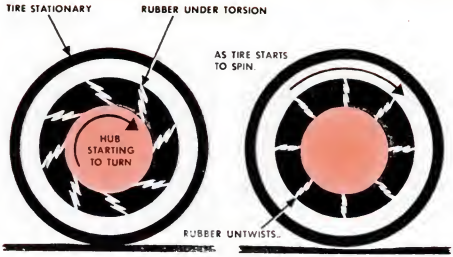
But H. J. Rand, president of the Rand Development Corporation, Cleveland, and a prominent inventor in his own right, had spotted it. He sent a Ford overseas to be fitted with the new wheels for testing. By May of this year the car had clocked 20,000 tough test miles, and Rand proceeded to acquire American and other rights to the invention.

What it does. An ordinary tire supports the car—and absorbs shock—only on the small "footprint" in contact with the road. The rubber wheel, like the spokes of a bicycle, does so all around. Because the load is so distributed, the rubber rings or sleeves can be much softer than a tire—and absorb more shock.

To prevent sidesway, a disk is bolted between the two halves of the wheel. The inner wheel surfaces touch the disk on sharp turns, preventing the rubber rings from yielding to side thrust.

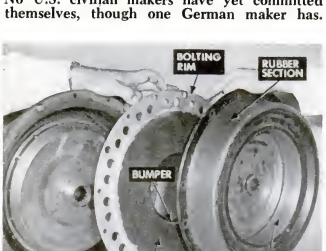
With rubber as a working spring inside the wheel itself, unsprung weight is reduced to a minimum. Look at your own car and you'll see that the tire, rim, wheel, hub, spindle, steering knuckle and suspension arms all have to lift to every bump in the road before spring-

HIGH-SPEED PICTURES reveal differences when motorcycle wheel strikes plank at 25 m.p.h. Strobe shot at top shows that impact energy makes conventional wheel bound into air. The shot just above shows that the rubber hub and the tire between them absorb most of the impact energy, which is "paid back" without a substantial amount of rebound.



WHEEL RESISTS SPIN for reason shown at left. Driving torque is transmitted through rubber, putting it under torsion (twisting stress). Should the tire break free of road surface and start to spin, this torsion in rubber is immediately relieved. For a split second the rubber transmits no driving torque. The spin, having nothing to maintain it, ends almost before it begins. Tests made on icy and wet surfaces indicate that cushioned coupling adds an extra safety factor here, too.

IDENTICAL TEST MOTORCYCLES differ only in use of rubber hubs, front and rear, in the one at left, and solid hubs in other. Rand Development Corp. is working on military applications. No U.S. civilian makers have yet committed themselves, though one German maker has.



SPRUNG WHEEL uses these parts, plus additional rim for tire. Rubber sleeves about ¼-in. thick are bonded between inner and outer sections of the parts at left and right above. Center disk is bolted between outer shells, and rides free between their flat inner surfaces with small clearance. Side loads, as in cornering, bring flat surfaces against center disk, preventing sidesway. Center disk also acts as bumper on extreme shocks, bottoming against shaft housing. These are parts of experimental Volkswagen wheel with integral brake drum.

ing starts to cushion it. In the rubber wheel, only the tire, rim and center disk are unsprung.

Minor road shocks are ironed out by the rubber sleeves before they ever reach the hub. The result, according to Rand, is that a light car rides like a Cadillac. Add minor results: body rumble vanishes, and the jolt of concrete road joints goes with it.

With sprung wheels, medium-pressure balloon tires give the same soft ride as today's low-pressure "marshmallows," while restoring some of the cornering ability we've lost to the big tires. You can get around curves with notably less squeal or sidesway.

Keeps its foot down. Other advantages of the rubber wheel are also surprising. Road coupling is much better—the tire keeps its foot down on the highway when an ordinary wheel would bounce. Brake chatter and the grab-slip-grab effect of braking on rough roads are largely eliminated. Braking pitch and deceleration shock are reduced. The rubber cushion between tire and brake drum softens every stop, while better road adhesion might make smaller braking areas feasible.

Another effect shows up on acceleration. It's virtually impossible to spin a rubber wheel on dry pavement. Shaft torque loads the rubber rings, putting them in torsion or twisting stress. The instant the wheel slips on the road, the rubber torsion lets go, momentarily releasing driving torque from the rim. The spin has nothing to keep it going.

Even on wet and icy surfaces, Rand tests show, this cushioned coupling goes far to bridge that fatal instant when rolling friction dissolves into sliding friction. Rubber wheels start more surely, skid much less than solid ones.

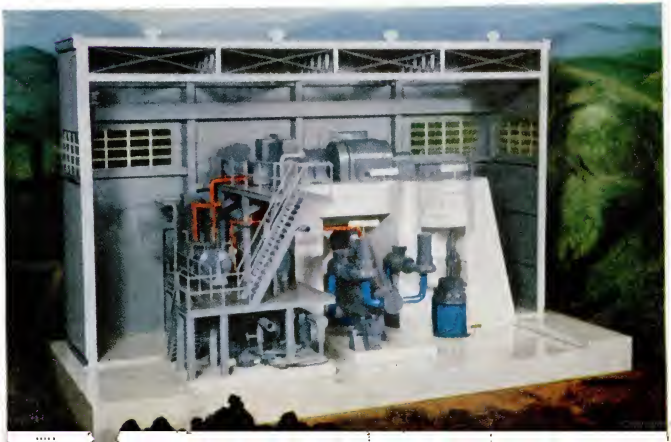
When will we have them? Rubber-sprung wheels will be standard equipment on all models of new German BMW motorcycles. W. H. Nichols, Rand vice-president, reports that his firm is working on military applications.

Older cars could be fitted with the new wheels, but would not make the most of them. (No wheels are as yet available to the public.) The reason: a return to stiffer springing, harder tires and a lower steering ratio would be possible with sprung wheels, with improved roadability and cornering as a bonus. Therefore new cars, redesigned for them, seem the best deal.

American wheel and automobile manufacturers are reportedly interested in the Rand rights. Some day your car may roll on rubber-sprung wheels. If it does, you'll like it. END

Nikes Poised to Strike are seen above in a four-missile test battery at White Sands, N.M. First guided missiles to join in U.S. defense, Nikes can intercept and destroy enemy aircraft regardless of visibility, weather and evasive tactics. The weapons, launched (right) by rocket boosters that drop away, are being mass-produced by Western Electric and Douglas Aircraft.

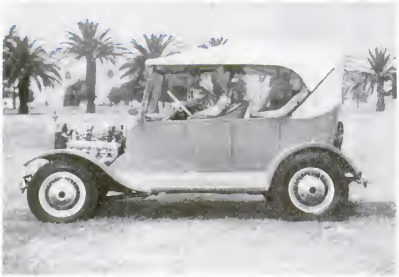
Packaged Atomic Power is forecast by this model of a small nuclear-power plant whose parts are transportable to remote regions by airplane or truck. The Army has already asked for bids to build a 1,700-kilowatt plant of this nature. American Machine & Foundry Co. sent the model to the current World's Fair in Sao Paulo, Brazil.



Californians Concoct Colorful Custom Cars

This Was a Model T

PUTTING 247 horsepower in a Model T makes a zesty vehicle. When Leroy Rayner of Compton, Calif., nudges the throttle of his hotted-up '54 Cadillac engine, the Model A Ford chassis nearly scoots out from under the ancient Model T body. Hydraulic brakes and tubular shocks help in the survival department, and radio speakers front and rear add a cool touch. Rayner can't surprise the unwary at stop-light brushes; engine is so big that the car runs without a hood.

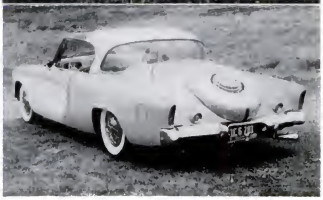


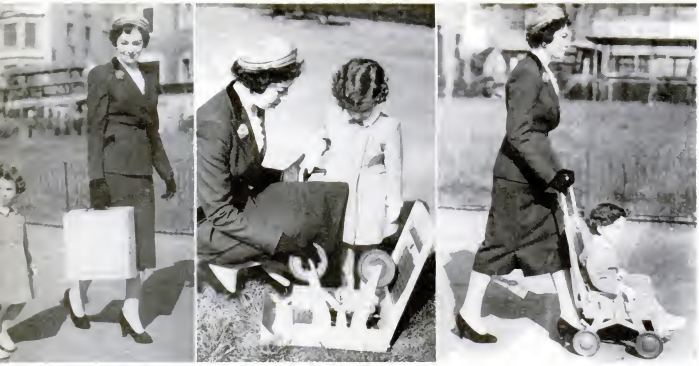
This Was a Studebaker

THOUGH you might think that a hardtop Stude is finished enough to appear in public, California architect Alfred Riggs didn't agree. With an assist from his wife, he spent 2,800 work-hours and $6,500 in turning out one of the plushiest cars imaginable. The body was dropped three inches, lengthened four, and covered with 67 coats of fluorescent lacquer.

In photos at left, note color in engine compartment; special plastic egg-crate grille; polarized, detachable plastic top; and elegant, tissue-thin leather upholstery. At right, note the gold-plated tools arrayed at one side of the padded, leather-lined luggage compartment, and the don't-trip-over-it look achieved by lowering and lengthening the body.

Riggs didn't skimp on the machinery. The bored-out mill runs at 10-1 compression and has special headers, a four-barrel carb and roller tappets. Electric latches release hood, deck and doors.





Stroller Unfolds from Suitcase to Give Tired Tot a Lift

If young legs give out on a visit to the zoo, you just open up this small suitcase, fold down the wheels and handle, and roll your tired little tourist the rest of the way home. The folding go-cart, made by the Pakopram Co., 784 High Road, Tottenham N. 17, England, was displayed recently at the British Industries Fair.

Carrier Gets Giant Tether

The largest chain ever used by the Navy will weigh anchors aboard the giant aircraft carrier USS *Forrestal*. Links like this one weighing 360 pounds give the chain a breaking strength of 2½ million pounds. The 4½-inch chain link held by the workman is used on small landing craft.

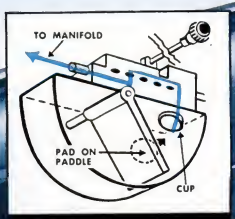
Power Adds Zip to Surfboarding

When Dick McGinley and Alan Rosendahl hanker for a little Florida surf hopping, they're never beached for lack of a tow. They scoot off to sea on motorized surfboards. Above, they race one another to get in trim for the annual motorboat race from Miami to Palm Beach and back.

Great Red Spot of Jupiter, mystery to science, peers like an eye from portrait of biggest planet by Wilson D. Hole, amateur astronomer and commercial color expert of Pasadena, Calif. Basing it on black-and-white photo taken with 200-inch Mt. Palomar telescope, he added accurate hues. Astronomers say his rendition excels direct color photos.

Air-Propelled Sled serves sports and commercial fishermen of Lake Superior's Apostle Islands area. This 16-footer, called newest and largest of its kind, skims ice (below) or open water. It has a 200-hp. aircraft engine, steers with an air rudder and carries over a ton of fish or nets for a commercial fishery.

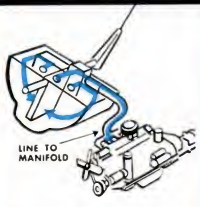
How a Windshield Wiper Works



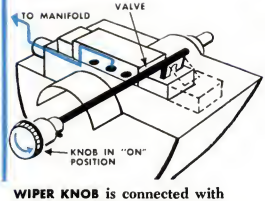
HERE'S WHY your wiper motor always stops blades out of your line of vision. Suction cup in motor does it. Closing valve links manifold to cup. When paddle hits cup, suction holds it.

Flipping those blades back and forth is a pushover for this clever, hard-working little motor that's powered by air trying to get into your car engine.

MAIN PARTS of wiper motor are a thick leather paddle and a half-cylindrical housing in which the paddle swings like a pendulum. Shaft turns with it. Wiper blade, or linkage for twin blades, fits on shaft end.



BLOCK ON TOP OF HOUSING has three ports on one side and a hose connection at one end. Center port leads to hose connection and line to engine's intake manifold. Other ports lead to two sides of paddle.



WIPER KNOB is connected with valve that sets up routes for air at normal and semivacuum pressures. In "on" position, line from center port to manifold is open and air is drawn in through this port.

WIPER-BLADE LINKAGE

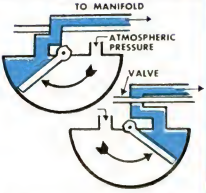
"ON-OFF" VALVE HOUSING

TOGGLE-ACTION MOTOR VALVE

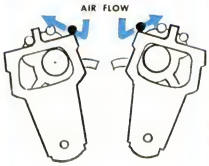
MOTOR HOUSING

OSCILLATING LEATHER PADDLE

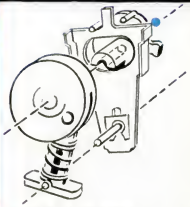
MANIFOLD-LINE COUPLING



BY BRIDGING THE CENTER PORT alternately with the ports on either side, pressure is reduced, first on one side of the paddle, then the other. Air entering the unbridged port kicks the paddle through its arc.



VALVE, which bridges two of three ports and uncovers the third, is shuttled back and forth by a kicker plate. Kicker must be tripped quickly at the end of each paddle stroke, to reverse unbalance of air.



KICKER IS TRIPPED by a spring-loaded disk engaged by paddle-shaft end during latter part of each stroke. Shaft turns disk past its center point of spring tension, producing toggle action.—*Henry B. Comstock.*

Hollywood Planets Wage

By Andrew R. Boone

PHOTOS BY ED ESTABROOK

ON A Hollywood sound stage, futuristic warplanes rode meteors' tails to attack a faraway planet. A red-hot flying saucer streaked through the earth's atmosphere at a velocity of 72,000 miles a minute.

METEOR'S CRASH upon imaginary planet, Metaluna, gives fiery explosion. Meteors are made of plaster reinforced with jute, and trail streaks of fire. Magnesium, chlorate of potash and thimblefuls of gasoline provide the fireworks.

They were staging a space war, between the people of the imaginary planets Metaluna and Zahgon. Movie-goers will see it this winter in the film *This Island Earth,* based on Raymond F. Jones' novel of the same name.

How do you visualize interplanetary warfare? That's where Stanley Horsley, special-effects director for Universal-International, and his experts came in. For the answers they consulted Mt. Wilson astronomers, watched A-blast films and studied designs for planes to come.

Made of aluminum, the movie's 18-pound flying saucer sailed past a background of 1,000 stars, patterned after a color photo. As the saucer approached Earth, lamps bathed it in red light to make it look red-hot from air friction.

Metaluna and Zahgon Fight It Out

A set resembling a cratered battlefield depicted the surface of Metaluna. Its inhabitants, in this science-fiction fantasy, try to repel fighter planes from Zahgon by ionizing an atmospheric layer with atomic energy. Red and green lights, flashed on a 22-by-115-foot background screen, simulated the aurora-like barrier. The script has fighter planes ride behind meteors to penetrate it, while a red ray, wielded by the defenders, destroys both meteors and planes. On the movie stage, models of meteors and fighters slid down blackened piano wires and blew up, when trip wires set off tiny explosive charges within them. Multiple exposures brought together the saucer, fighters and red ray.

Staging special effects with miniatures is painstaking, costly business. Shooting the scenes took 26 days; matching bits of action on the frames, 15 weeks. The make-believe in this 16-minute bit of the film cost $100,000 to produce.

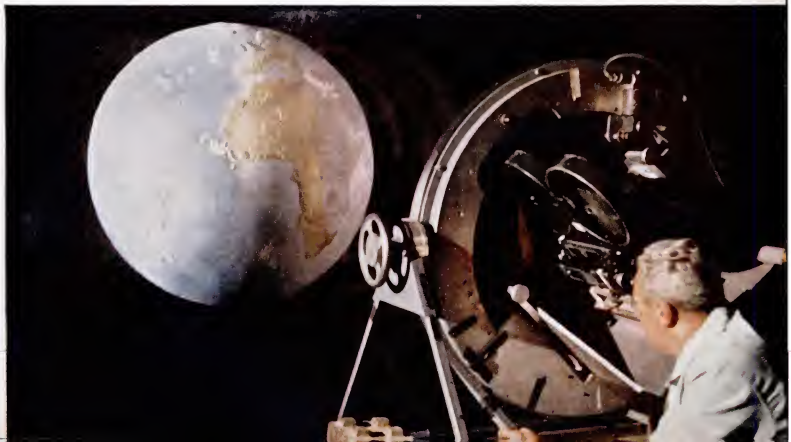
Space War

Plane and saucer models fight interplanetary battles to film this new science-fiction thriller.

CAREFUL MEASUREMENTS precede scene of plane attack on flying saucer, to keep all in scale.

SAUCER FLIES against background of 1,000 Northern Hemisphere stars, duplicated on a curved screen from Mt. Wilson photo. Precision gearing turns camera to follow spaceship.

CAMERA ON DOLLY sees Earth as from descending saucer. "Mist" on glass and jagged-edged hole in black curtain give atmospheric halo around five-foot globe turned by motor. END



Gus Goes Dowsing for Water

By Martin Bunn

GUS'S sleepy eyes focused on the bedside clock as his hand reached out to silence the telephone. It was five o'clock in the morning.

"Is this Mr. Wilson?" an eager voice inquired over the phone. "I'm Barney Overholtz. The crankcase of my car is full of water, and I've got to deliver my newspapers."

Gus was of a mind to hang up and go back to sleep. Then a mental picture came to the Model Garageman of Barney's thin young features, and he didn't have the heart to do it. Barney was 17 and as freckle-spattered as a brook trout. He had the trustful brown eyes of a cocker spaniel.

"Hold your horses, kid," Gus told him. "I'll be right over."

At Barney's house, Gus checked the oil stick of the kid's 1941 Ford. Then he did the only thing possible at the moment—for Gus. He loaded Barney's papers in his tow truck and started delivering them over Barney's rural route. Folks who were up this early were startled at the strange dawn vision of the burly owner of the Model Garage. Gus was flipping papers onto the porches, with Barney grinning at the wheel.

Gus Takes a Car Case History

"Now about this car of yours," Gus said. "You've had it about a month, haven't you? Have you ever let it run out of water and get hot? It's not been cold enough to freeze and crack the block."

"It's never been hot," Barney assured Gus.

"In that case," Gus declared, "since you bought it over in the city, you should contact your dealer there. He should fix it."

"Gosh!" Barney exclaimed. "Do you think he would?"

At that moment Gus was inclined to think that he wouldn't. Most used-car dealers in the city were honest, but it was an old trick of unscrupulous dealers to put a temporary repair on a cracked block, and foist the car off on some unsuspecting character like this kid. The car would run all right for a few days, but then the crack would open up and fill the crankcase with water.

"I'll have to have it fixed right away," Barney said, his eyes anxious, "or Mr. Thompson will take away my paper route."

A Ribbing for the Model Garageman

As soon as the newspapers were delivered Gus took Barney home and towed the water-logged Ford into the Model Garage. He got a quick breakfast at the café, where Officer Corcoran kidded him.

"My paper was late this morning, Gus," Corcoran declared. "It had greasy fingerprints all over it. The next time this occurs I'll have to report you to Mr. Thompson."

"If it occurs again," Gus chuckled, "I'll be going to bed at dusk, so I can get up at five. Barney jangles a mean telephone."

Back at the garage, Gus put in a long-distance call to Stevens and Bartlett, the used-car dealers where Barney had bought the car. Their attitude in the matter was about what Gus had expected.

"The car was all right when the kid took it out," Stevens told Gus. "We couldn't be expected to repair a water leak on an old car like this, after it's been

A freckle-faced youngster had put his faith in the Model Garageman. And somehow, Gus had to trace the leak that, drop after mysterious drop, was eroding the kid's hope.

Gus was flipping papers onto the porches, with Barney Overholtz grinning at the wheel.

driven 30 days on a paper route. Kids do things to cars, you know."

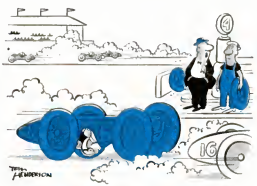
"I know," Gus said wearily, "and so do some dealers."

Gus hung up, wondering about what kind of an outfit Stevens and Bartlett were. He began working on the car. He drained water and oil, pulled the heads, began scraping carbon, inspecting gaskets for imperfections, block faces and valve ports for cracks. Stan Hicks, Gus's helper, strolled from the grease rack, grinned widely at Gus.

"You always were a sucker for kids, Gus," he said.

"It isn't that," Gus protested. "I'm just curious to see if this used-car outfit is trying to gyp Barney Overholtz."

The carbon on heads and block faces was dry, indicating rings in good shape. There were no signs of water having been in the cylinders. There were no cracks, even at those danger points between valve ports and cylinders. Gus was puzzled. There had to be a crack some place. It must be inside the valve compartment.



"Looks like that far turn has been giving Ed a little trouble again."

Cylinder Walls Are Undistorted

A crack in a cylinder water jacket, inside the valve compartment, Gus told himself, seldom occurs unless a car has been badly frozen. He ran his inside micrometer around in the cylinders. Its reading showed that the car had been rebored to 60 thousandths oversize, yet there was no distortion of cylinder walls, such as would have been the case if the car had been badly frozen. Really, except for the mysterious crack, the old heap was in exceptional shape.

Gus pulled the generator and then the manifold, which on a Ford V-8 also acts as the valve-compartment cover. At once he saw water mixed with oil. This meant nothing, since water would have been pumped up here from the crankcase with the lubricating oil. It would be almost impossible, Gus knew, to locate a crack in here visually, without pulling valves, springs and guides, and cleaning the compartment with steam. Gus cleaned it the best he could, using a solvent spray and blowing out with compressed air. He could find no cracks, and being certain that there were none in the compression chambers, he replaced the engine head and filled the radiator with water.

Gus peered about in the valve compartment, seeing no water flow. Maybe the crack was way at the bottom of the block. This hardly seemed likely, but could not be overlooked. Gus pulled the pan, lay under the motor, looking up. He was there for perhaps five minutes, before he saw a single drop of water drip from the front throw of the crankshaft, which was in the down position. Just at this moment the phone rang.

"This is Stevens," a voice said over the wire. "You understand, Wilson, that the 30-day guarantee on young Overholtz' car has expired. Still, we'd like to know what's wrong with the car."

"At the moment," Gus said, "water is leaking out of the crankshaft."

"Out of the crankshaft!" Stevens repeated. "Never heard of such a thing."

"Neither have I," Gus told him as he hung up.

Getting under the car again, Gus found, by turning the crankshaft, that the water was very slowly issuing from the timing-gear case. If there was a crack up there, behind the timing gears, Gus told himself, they might as well junk this motor. He crawled out, backed to the bench and lit his pipe.

There was something queer here, Gus thought. A crack caused by a freeze-up, in a car that had been rebored to 60 thou-

[*Continued on page 250*]

MECHANICS and HOMEBUILDING

How to be a Do-It-Yourself Santa Claus

Your workshop can make this Christmas the Christmas. Here are toys of a kind and quality few people can buy. Here are decorations to make your house the envy of the neighborhood. And here's how to make them —15 pages of plans, patterns and details.

Tiny Refrigerator
Page 187

Toy Power Saw
Page 179

Pint-Size Lathe
Page 184

Miniature Range
Page 182

Here's a new way to trim a

Christmas Window

It's easy to make your display a unique one this year by using these patterns to cut plastic.

Your window can look like this for Christmas.

YOUR Christmas this year can be white whether it snows or not. All you need is a white foam plastic that makes beautiful window decorations.

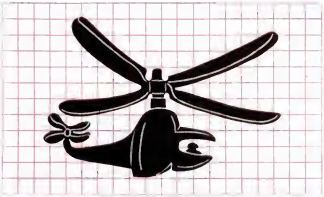
Even if all your 10 fingers are thumbs when it comes to carving, you can wow the neighbors with this stuff, called Styrofoam. Five special designs—the kind you won't find duplicated in the stores—have been worked into patterns for you to follow. Two (on the following pages) are reproduced full size. You don't have to scale them up. Just lay the magazine page and ordinary carbon paper over the plastic, then trace the outline with a hard pencil. These designs were created for POPULAR SCIENCE MONTHLY by William Becker of Terre Haute, Ind.

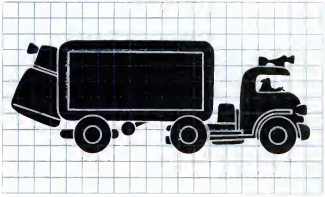
The material itself is wonderfully easy to work with. Frosty white and amazingly light, Styrofoam comes in all sizes

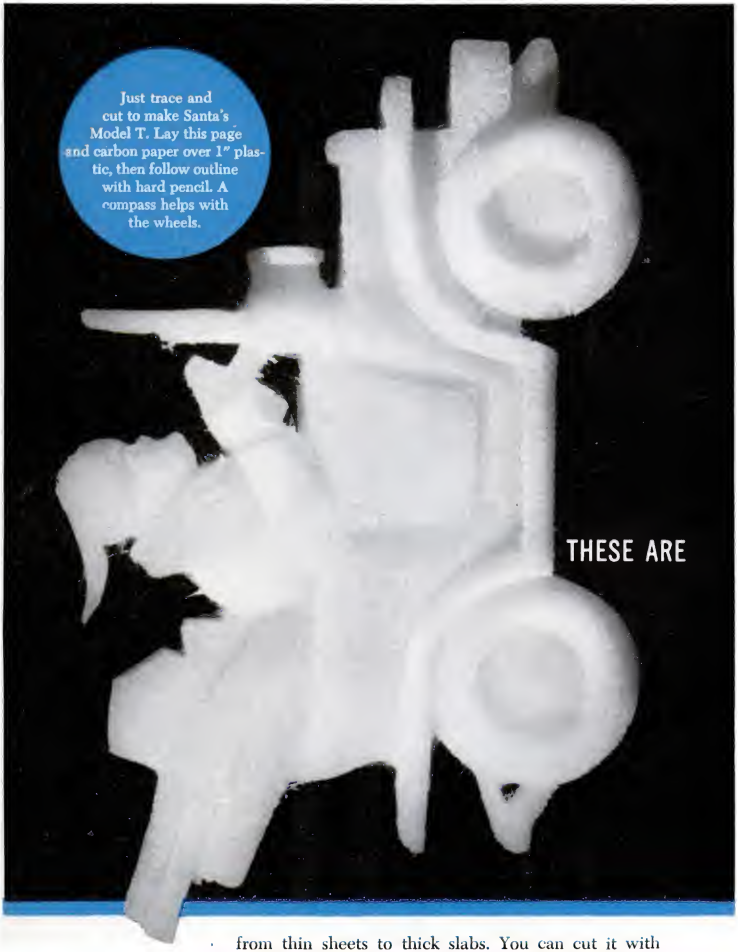
CHRISTMAS TREE for table or mantel decoration shows easy way to get three-dimensional effect by rolling thin sheet into cones. Tubes, boxes are made in same way.

CANDELABRA looks complicated, is actually just a combination of different thicknesses of flat carvings —1" for candles, ½" for reindeer, a thin sheet for the gracefully curling leaves—all simply glued and mounted on 1" base.

Patterns help you to reproduce these distinctive decorations in foam plastic that is easy to carve.







THESE ARE

from thin sheets to thick slabs. You can cut it with anything that has an edge—knife, coping saw, jigsaw or carving tool. Household cement glues it and rubber-base paint colors it. To smooth edges and shape contours, you just rub with a block of the same plastic.

Not as tricky as it looks, this pioneer loco can be easily carved if you make internal cuts first, so that thin parts won't break off.

FULL-SIZE PATTERNS

Except for the rocket ship, all of the designs shown are cut from flat slabs 1″ thick. You can add the raised detail by hollowing out portions, or you can leave them simple silhouettes.

If your wife has cookie cutters in animal shapes,

Impressively big, rocket-borne Santa can fill a window. Body is glued up from 2" strips, has wings carved from 1" slab. Santa himself is shaped in sections, then glued together.

1" SQUARES

you can whack out a whole menagerie by heating the edges and pressing them gently into the plastic. Perfect circles can be made with heated tin cans and pan lids.

Styrofoam is available at many flower, hobby and novelty shops, or from the manufacturer, Dow Chemical Co., Midland, Mich. END

Build your young craftsman a

Toy Power Saw

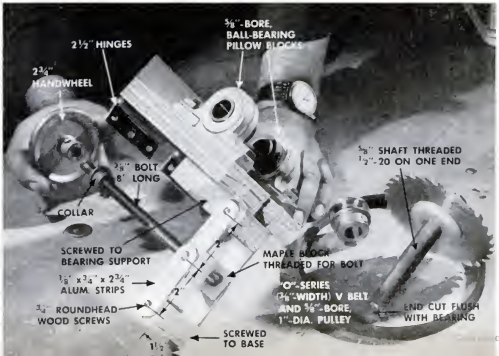
Underpowered for safety, this tool can rival Dad's at handling light stock.

By Herb Pfister

HALF the size of your basement table saw, but capable of performing every bit as well on light materials, this toy table saw will make a knockout gift to present to your son (age 10 or older) on Christmas morning. The 4″ blade, powered by a safely weak 1/20-hp. motor, won't kick work back at him. But, with light feed and tender guidance, it will cut through softwood up to ¾″ thick. A simple lowering mechanism enables the blade to be adjusted to any height for cutting dadoes.

JOIN HARDBOARD SIDES with wood corner molding and corner cleats to make saw body. Open panel gives access to raising mechanism and permits easy cleaning of accumulated sawdust.

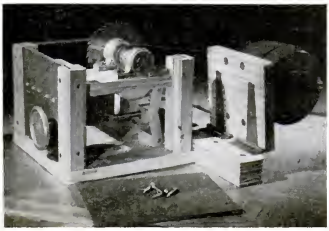
What you will need. Begin by purchasing a pair of ball-bearing pillow blocks and a short length of ⅝″ shaft, shouldered to ½″ and threaded on one end. Also a fine-tooth 4″ blade, a 2¾″ handwheel and a set of O-series pulleys and V belt. The motor shown is a GE



SAW-BLADE HEIGHT ADJUSTMENT is shown removed but in relative position. Collar on long ⅜″ bolt bears against inside of hardboard panel when raising blade; handwheel bears against outside when lowering it. Maple block is threaded just like metal by running well-oiled tap in tap-size hole. Aluminum angle keeps sawdust from getting behind hinges.

BLADE GUARD
MITER HEAD
FENCE
T HEAD
SLIGHT TAPER
SLOT FOR BLADE
INSERT PLATE, HARDBOARD
LOCK BLOCK, HARDBOARD
TABLE TOP, TEMPERED HARDBOARD
SPACE FOR MITER-HEAD BAR
PIVOT SCREW
HARDWOOD STRIP
GUARD
SAW TABLE, PLYWOOD
FENCE SUPPORT
SPLITTER
GROOVE TO CLEAR V BELT
SCREWS
CUT OUT TO CLEAR BLADE AND BEARINGS
SAWDUST SHIELD, ALUMINUM ANGLE
SAW-ARBOR SUPPORT, PLYWOOD
SLOT TO CLEAR V BELT
CUT AWAY FOR SAW BLADE
CORNER CLEATS
ELEVATING MECHANISM (SEE PHOTO)
CORNER MOLDING, 6" LONG
SPLITTER (ALUMINUM)
T HINGE FOR MOTOR BASE
HARDBOARD SIDES, 6"×7½"
WOOD SCREW INTO CLEAT
FILLER BLOCK, PLYWOOD
MOTOR SUPPORT, PLYWOOD
BASE, PLYWOOD
RUBBER-HEAD SCREWS
FRONT AND BACK, HARDBOARD
SPLITTER BASE (PINE)

SET UP FOR TEST RUN. Side panel is removed to show mechanism installed. As handwheel is turned to the right, threads on the bolt pull maple block back, and the aluminum arms lower bearing support. Weight of motor on the hinged base keeps the ⅜" V belt taut.



1/20-hp. job, wound for counterclockwise rotation.

Assemble the body and attach it to the base with 1½" wood screws driven up into the corner cleats. Assemble and install the saw bearings and raising mechanism and mount the blade on the shaft so that you can locate the opening in the saw table. Cut a piece of ¾" plywood to size, cut an opening in it for the bearings and blade, and screw it to the top of the

body. Cover the plywood with ¼″ tempered hardwood, leaving a ½″ space between the two pieces to form a groove for the miter-head bar. Cut an opening in the hardboard around the blade and make a hardboard insert plate to fit it.

Supporting the motor. Screw a strip of ¾″ plywood across the back end of the base to support the motor. Add a short length of plywood to the underside of the strip where it overhangs the base to keep the motor's weight from tipping the saw. Bolt the motor to a 6″-square piece of plywood and hinge it to the support strip. Mount a 1¼″ pulley on the motor using a bushing to make the ½″ bore fit the light 5/16″ shaft. Run the wires through a toggle switch mounted on the side of the saw.

The fence, miter head and blade guard are made from pine. Cut the guard to shape, rout ¼″ grooves on each side using a fence clamped to the drill-press table to rout in straight lines, and clear out the center by making successive passes over your saw blade until the groove for the blade is about ⅜″ wide. Slot the end with one saw cut to fit over the splitter. Shape the splitter from 1/16″ aluminum and screw it to a wood base fastened to the underside of the table in line with the blade.

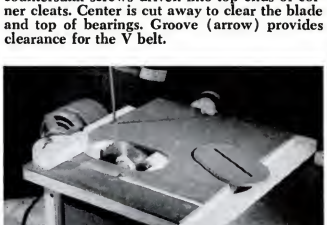
Making the fence. Use a piece of straight-grained pine for the fence and fasten the T head to it with screws and glue. It is locked in place by means of a small block of hardwood screwed to the outer end An Allen-head screw, threaded into the fence end, draws the hardwood block tightly against the table's edge.

Shape the miter head from one piece of 1¼″ pine and fasten it to a ¼″-by-½″ hardwood strip with one flathead screw which acts as a pivot. Clamp the strip in a drill-press vise and rout the curved slot for the locking screw by turning the head on its pivot while the router cuts.

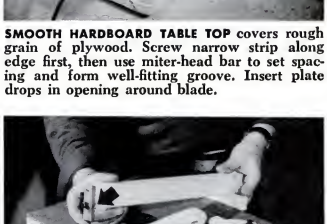
Finish the saw with machine-gray enamel and paint table top silver. END

Where you can buy the parts: The O-series V belts and pulleys, ⅝″ wide—Frank Tracy, Inc., 202 Centre St., NYC; the GE motor, 1/20 hp., counterclockwise rotation—American Surplus Trading, Inc., 332 Canal St., NYC.

PLYWOOD TABLE is fastened to the body by countersunk screws driven into top ends of corner cleats. Center is cut away to clear the blade and top of bearings. Groove (arrow) provides clearance for the V belt.



SMOOTH HARDBOARD TABLE TOP covers rough grain of plywood. Screw narrow strip along edge first, then use miter-head bar to set spacing and form well-fitting groove. Insert plate drops in opening around blade.



FENCE, GUARD AND MITER HEAD are shaped from clear pine. Slight taper (arrow) on end of fence permits the hardwood block to be drawn tightly against the edge of the table when Allen-head screw is hand-tightened.

Warm a little girl's heart with this

Miniature Range

SPACE FOR TOY POTS AND PANS is covered by hinged doors on each side. Oven has a clear-plastic window for keeping a careful watch on mud pies. Drawer beneath the oven holds other tiny kitchen equipment.

PUSH BUTTONS GALORE control dummy burner elements. The elements shown are coiled wire soldered to brass strips, but added realism could be obtained by making the elements out of clear plastic and then lighting them individually with red flashlight bulbs.

Make-believe mud pies become almost real in this beautiful range that's just like Mom's.

By Lloyd M. Frazier

ANY little girl is at home with a range—a toy one, that is. This scaled-down model will bring squeals of delight on Christmas morning and is no more difficult than building a wooden box and rounding the corners.

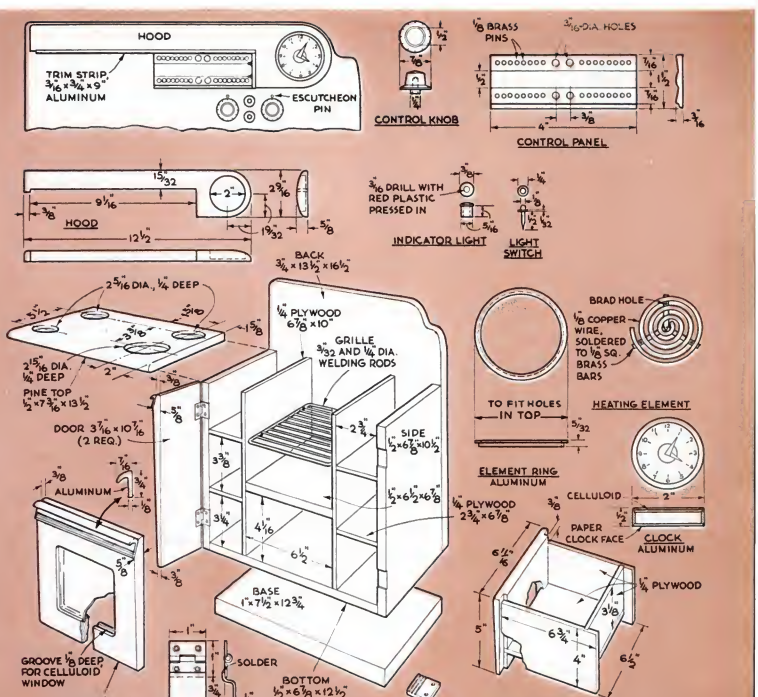
Edge-glue two pieces of ¾″ pine for the backpiece and shape the upper right-hand corner to match the hood. Make the top, sides and bottom from ½″ pine, glued and nailed, and attach to the back, using butt joints in all.

Use ¼″ plywood for the partitions and side shelves and ½″ pine for the shelf that supports the oven door. Cut all doors from ¾″ pine and fasten them in position on plywood. Then jack-plane a taper from top to bottom on all four pieces at once so they'll match. Cut out the oven-door window and groove the opening to receive a piece of heavy celluloid.

Hinging the doors. Use 1″ brass hinges for the side doors and make offset hinges for the oven door by soldering extensions cut from 1/32″ brass to a pair of 1″ hinges.

Staple a short length of key chain to hold the oven door when open. Make the pan drawer from ¼″ plywood and fasten to the planed drawer front. Attach a ⅛″ aluminum tab to the bottom for a drawer pull.

Hood and trim. Nail strips of aluminum counter molding to the tops of the doors for door pulls. Shape the hood from 1″ pine, bore the clock opening,



and trim the under edge with 3/16"-by-¾" aluminum strip.

File a flat piece of 3/16" aluminum to shape for the control panel and drill holes for the 30 control buttons and indicator lights. Insert short pieces of ⅛" brass rod for the buttons, making four longer to act as nails to fasten the panel on. Press four 3/16"-diameter disks of red plastic into the indicator-light holes.

Turning the dials. Turn the timer and oven dials from ⅜" aluminum rod and scribe marks around their edges. Turn their two indicator lights from 5/16" aluminum rod and press red plastic into their recessed faces.

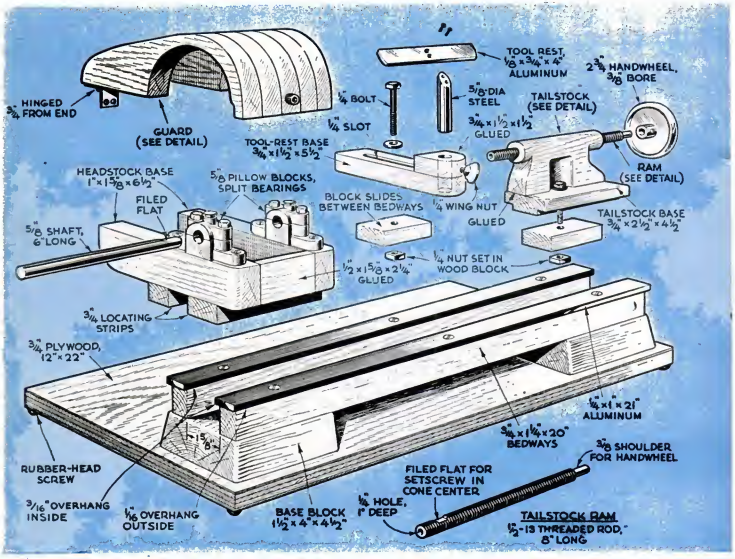
Turn the clock and burner rings from aluminum rod and coil ⅛" copper wire for the burners. Draw the clock face with India ink on colored cardboard.

Bend ¼" welding rod into a square frame for the oven shelf and solder 3/32" wires into holes drilled in the sides.

Finish the outside with white gloss enamel and the inside black. Paint the hood to blend with the tiny housekeeper's kitchen color scheme. END

Delight your boy with this workable

Pint-Size Lathe

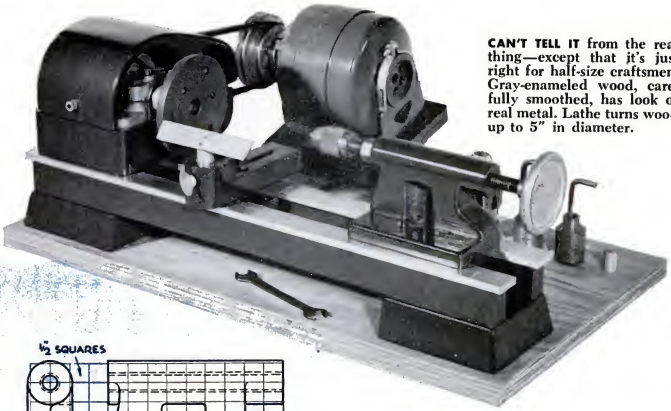


Made for standard lathe parts, this mighty midget swings a turning neatly for beginners.

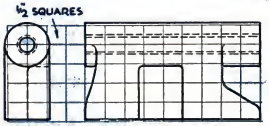
YOU can start your boy on his way to many happy years of craftsmanship with this half-size reproduction of the king of power tools—a lathe. Made from parts you can pick up at almost any hardware store, it really works. With it, he can turn out wood parts for models, a lamp for Mom, or even shape brass.

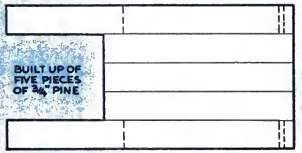
On a ¾"-plywood base about 12" wide by 22" long, screw two blocks in line with each other. Bridge these with pine strips and screw on two 21" strips of ¼"-by-1" aluminum for the lathe bed.

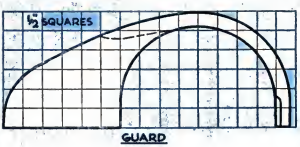
Assembling the headstock. Make the headstock-bearing support from pine, with two strips to straddle the bed. Mount two split-bearing pillow blocks on the base so that the shaft center is ⅜" behind the center of the lathe bed and



CAN'T TELL IT from the real thing—except that it's just right for half-size craftsmen. Gray-enameled wood, carefully smoothed, has look of real metal. Lathe turns wood up to 5" in diameter.







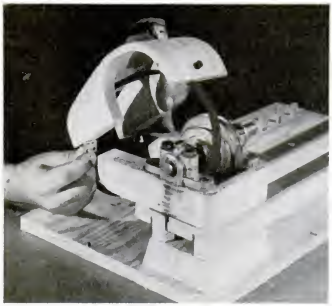
LATHE BED is built up of pine and aluminum strips. Screws through plywood base hold end blocks, beveled on three sides, in place. Strips are screwed down from above. Place aluminum strips so that 3/16" overhangs on inside edges, leaving 1/16" overhanging on outer edges.

2½" above it, providing a swing of 5".

Cut the large steps off two four-step cone pulleys (0 series, for ⅜" V belt) to reduce them to toy-lathe size. Mount one pulley between the bearings with two ⅝" collars on both sides of the front bearing. Mount a 1/20-hp. motor on a 6" square of plywood and hinge it to the base so that its weight keeps the belt taut.

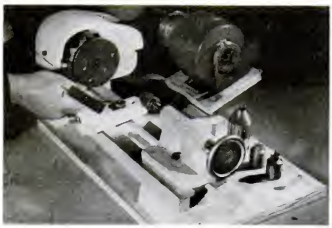
Cut two pieces of ¾" pine for the sides of the belt guard and three pieces for the

HEADSTOCK is secured on bed by two pine strips on its underside that straddle the rear bedway, and a single long screw driven into the base block. Three screws, countersunk and filed flush, hold each aluminum strip in place.



BELT GUARD is glued-up sandwich of five pieces of pine hinged to back end of headstock-bearing support. Centerline of bearings is ¾″ behind center of bed, eliminating excessive tool-rest overhang when turning large diameters.

TAILSTOCK-LOCKING BLOCK has nut embedded in bottom surface. Bolt through tailstock base clamps block against underside of overhanging aluminum strips. Lathe accessories shown in foreground are: ¼″ tailstock chuck (left), tailstock cone center, headstock spur center, ½″ headstock chuck and 3¾″ faceplate.



TOOL-REST LOCKING ARRANGEMENT is same as for tailstock. Bolt is tightened in nut embedded in bottom of block cut to slide between wood bed strips. Note short pieces of dowel glued in baseboard to keep accessories right at hand.

center. Glue all five together and sand them smooth.

Aligning the tailstock. Cut a 2¼″-by-4½″ piece of 1⅛″ pine for the tailstock and screw it temporarily on a T-shaped base to slide between the bedways. Slide it up to a cone center on the headstock, mark the mating center on the tailstock block, and drill a 5/16″ hole through the block. Run a ½″-13 tap through the hole as far as it will go, then finish the thread by filing notches on ½″ Thredrod and twisting it through the hole.

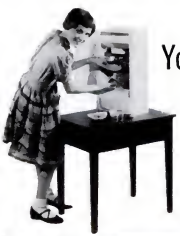
Cut the rod to 8″ and shoulder one end to ⅜″ for a 2¾″ handwheel. Remove the block, carve it to the shape shown, sand it smooth, and remount it with glue to keep the screws from slipping under headstock pressure.

Cut a small block of pine to slide between the wood bedways, drill a ¼″ hole in line with the hole in the tailstock base and press a ¼″ nut into the bottom for the tailstock-locking bolt.

Making the tool rest. Glue a 1½″-square of ¾″ pine to a 1½″-by-5½″ strip to form the tool-rest base. Rout a ¼″ slot along its center and drill a ⅜″ hole for the tool-rest support. Make a block similar to the tailstock-locking block for the tool-rest locking bolt. Screw a 4″ strip of ⅛″-by-¾″ aluminum to the beveled end of a short piece of ⅜″ aluminum rod to make the tool rest. A wing bolt tapped in the wood locks the tool rest to any height or angle.

Finishing. Shellac the plywood base to resemble a bench top and finish the wood parts of the lathe with machine-gray enamel or lacquer. Screw rubber-head screws under the base for scratch-free operation on the kitchen table.

Slight alterations must be made in several accessories to adapt them to the lathe. The ¼″ tailstock chuck will most likely have ½″-20 threads in its shank. Drive a ½″-13 tap into the bore to make it fit the ½″-13 Thredrod. The tailstock spur center is bored ⅜″ for use on the Shopsmith headstock. Drill a ½″ hole through a short length of ⅜″ brass rod to make a bushing to adapt it to the ½″ Thredrod tailstock. END



Your little girl will love this

Tiny Refrigerator

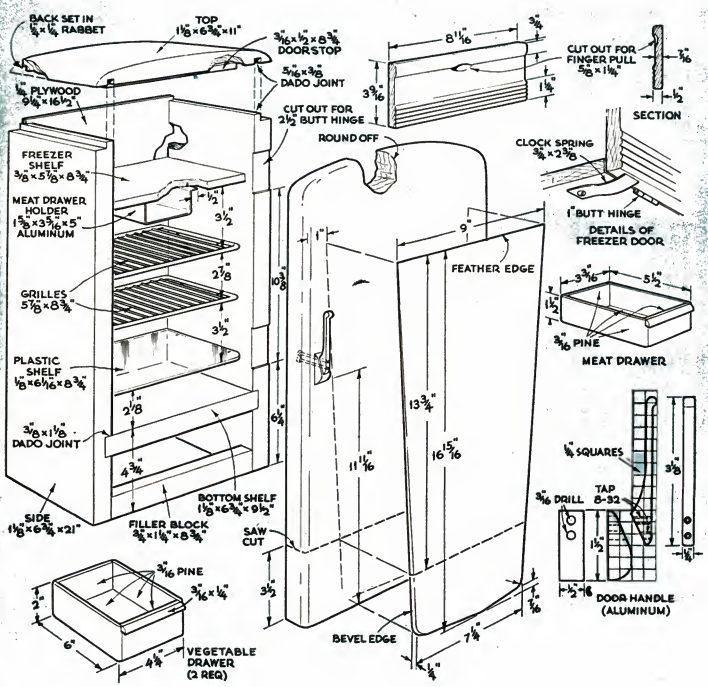
PLENTY OF ROOM FOR PLAY. Two vegetable drawers, a freezer compartment and meat drawer beneath it provide storage space for make-believe perishables. The shelves are made out of welding rods, but wire clothes hangers would do just as well. The box itself is made of wood.

Complete with freezer unit and removable food trays, here's a fine companion for toy range.

A TOY refrigerator is a necessity in a little girl's kiddie kitchen, and one as handsome as this scaled-down model is hard to find at a price that fits the toy budget.

Make the sides, top and bottom from 1⅛″ pine, fit them together for a trial assembly, then separate them and cut the rabbets along the back edges for the ¼″ hardboard back. Fold a sheet of heavy paper down its center and draw half the outline of the refrigerator body on it. Then cut out the shape and use it as a template for shaping the body and the door.

Shape the door and lower front cover from one piece of 1⅛″ pine. Cut the raised panel from ¾″-thick pine, bevel the edges and glue it on the face of the door. Then plane it to a feather edge at the top. Sand smooth and cut off the lower part to make the lower front cover. Hinge the door to the body with



2½" butt hinges and glue the lower cover in place directly beneath it. Screw a friction cupboard catch to the inside of the door to hold it shut.

Cut the door handle and its base from aluminum and drill holes in both parts for the mounting screws. Tap the holes in the handle and drill the base holes for clearance. Insert the screws through matching holes in the door, through the holes in the base and thread them into the tapped holes in the handle to assemble and mount it at one time.

Make the freezer compartment by nailing a ⅜" pine shelf inside the box and hinging the freezer door to it. Trim on this door can be extruded aluminum or wood beading painted silver.

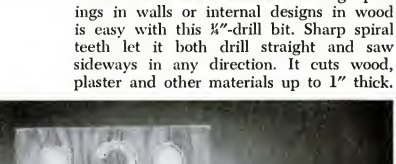
Fabricate the food shelves by bending ¼" welding rod into two rectangular frames and inserting 3/32" rods in holes drilled in the front and back edges. A piece of ⅛" plastic makes a durable shelf over the vegetable drawers. Paint the refrigerator inside and out with white enamel and add a name plate.

New Tools

1. Baby Chain Saws Go Anywhere. Light enough to wield with one hand, the electric saw at left weighs only 7½ lb. yet will fell a 14″ tree. The saw below weighs only 20 lb. with self-contained gasoline engine and will cut timber up to 3′ thick.

2. Clamp Grips Quickly. You can set this C clamp in a second without screwing it all the way in and out each time. The outer barrel is slid up against the work, locked, then the inner stem is screwed up tight. A quarter turn of the barrel releases it instantly.

3. Drill Bit Saws Holes. Cutting openings in walls or internal designs in wood is easy with this ¾″-drill bit. Sharp spiral teeth let it both drill straight and saw sideways in any direction. It cuts wood, plaster and other materials up to 1″ thick.



4. Small Wheels Make Big Grinder. You can stack up to five of these flexible grinding wheels on a single shaft, covering broad work areas quickly. The wheels, each 1″ wide, come with different-length shafts depending on the number combined.

Further information on the tools shown on this page can be obtained from: 1. (electric model) Porter-Coble, 47 Exchange St., Syracuse, N. Y.; (gasoline model) McCulloch Motors Corp., 6103 W. Century Blvd., Los Angeles 45; 2. Techno Products, Inc., 1908 E. 66th St., Cleveland, Ohio; 3. Benrich Sales, P.O. Box 64, Central Station, Jamaica 35, N. Y.; 4. Merit Products, Inc., 4023 Irving Place, Culver City, Calif.

Simple in design . . . handsome in appearance

Colonial Cupboard Is Easy to Build

Got a knotty storage problem? This slim knotty-pine locker will lick it—and dress up your hallway, too.

By Karl Greif

IF YOU have an Early-American-type home and are stumped for storage space, this shallow colonial cupboard should be right down your alley—hallway, that is. It's as frugal as Old Mother Hubbard in saving valuable floor space. Yet it has a surprising amount of shelf area.

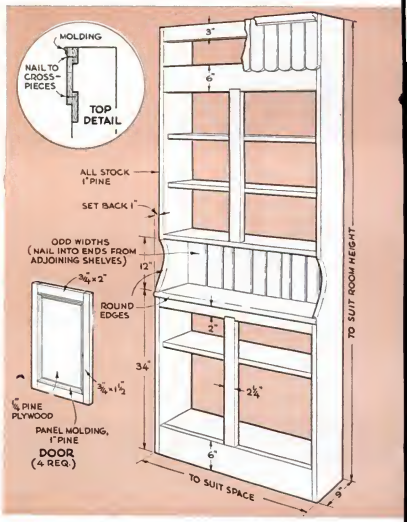
Naturally, your cupboard must be adapted to the space at hand. But whether it does a three-way stretch or shrinks to the proportions of a totem pole, the construction remains the same.

Sides. The two side members are ripped out first. They should extend from floor to ceiling. A curved section is removed from the forward edge of one side if the cupboard is to butt against an angle in the wall, or from both sides if it is to stand free.

Shelves. Make the shelves next, and glue and nail them between the sides. With the exception of the open shelf, their forward edges are recessed ¾" from the front of the cupboard. This will provide a flush fit for the doors.

The open shelf should project an inch beyond the face of the cupboard. It also has small extensions at the front, to lap the cupboard sides.

Front and back. Three cross members frame the doors. The top of the kickboard butts against the facing edge of the bottom shelf, and the intermediate crosspiece bears against the bottom of the projecting shelf. The top member may be extended to the ceiling or, as shown in the detail drawing, it can be projected just high enough to support the vertical, scalloped strips that ornament the cupboard top. In that case, another supporting piece must be nailed between the cupboard sides at the top. Both the top and intermediate cross members have cutouts at their centers to receive door-separating uprights.



SIDES, SHELVES, FACING AND DOOR FRAMES for the cupboard are all cut from ¾" stock. True knotty pine is best, but well-seasoned and less expensive common pine will do.

Random-width strips form the back of the open cupboard section. Plane their butting edges to form shallow V grooves, and glue and nail the strips between the shelves above and below them.

Doors. The doors are of simple frame-and-panel design. Cut grooves on the inside edges of the butted frame pieces to grip ¼" plywood panels and dress up the insets with molding. Attach the doors to the cupboard with authentic colonial-hinge reproductions and use matching latches.

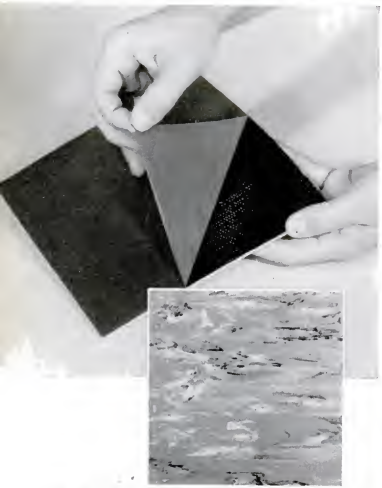
Installing and finishing. Set the cupboard in the space you built it for, profile the top and bottom to fit your baseboard and ceiling moldings, and nail it rigidly in place. A few strips of molding around the top and you're ready to sand and finish this handsome addition to orderly living. Use a commercial maple stain, sealing it with shellac.

ROOM FOR A SPACIOUS LINEN LOCKER? You'd hardly think so, but see what the author did with the 9" strip of previously wasted hall space outlined by the carpeting and baseboards.

GRACIOUS AND FUNCTIONAL, cupboard is an eye-filling showpiece. The open section and scalloped top add beauty to what otherwise would have been just a practical cabinet.

New for the Handy Man

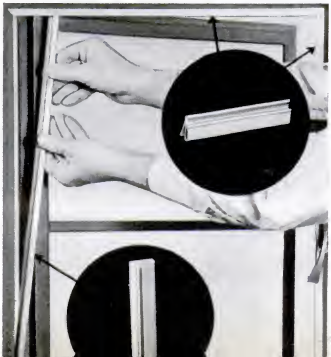
1. Paint Remover Sprays On. With a new spray can, you can quickly spread a smooth, even film of paint remover over large areas or in corners that are hard to reach by brush. The non-flammable chemical cuts through difficult-to-remove varnish as well as paint, shellac and lacquer.



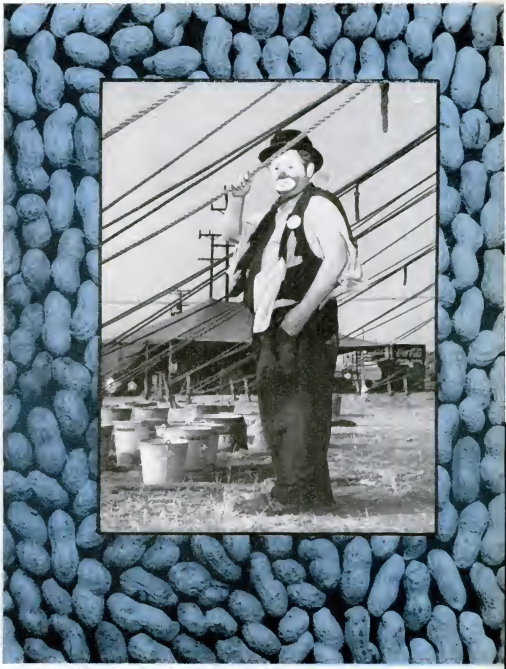
2. Floor Tile Has Own Adhesive. Just peel the film off the back of this new rubber floor tile and it's ready to lay. The tiles, which come with the adhesive already on, are simply set in a solvent that's swabbed on the subfloor first. They're available in 52 colors and styles.

3. Adapter Takes Grounded Plugs. Tools and appliances that have three-prong, grounded plugs can be used in standard outlets with this adapter. The adapter is plugged into the outlet and its grounding wire attached to the plate screw, then the three-wire cable is plugged into the adapter.

4. Weather-Stripping Casement Windows. You can weather-strip casement windows without special fasteners by simply slipping this metal stripping over the window frames. Using ordinary scissors, the strips can be mitered at the corners and cut to any length to fit odd-size windows.



Further information about the products shown on this page can be obtained from: 1. E. I. Du Pont de Nemours & Co., 6529 Nemours Bldg., Wilmington, Del.; 2. Robbins Floor Products, Tuscumbia (Muscle Shoals), Ala.; 3. Cable Electric Products, 234 Doboll St., Providence, R. I.; 4. Macklanburg-Duncan Co., Box 1197, Oklahoma City, Okla.



Here is a neat darkroom stunt: With a homemade cardboard mask and a suitable negative you can

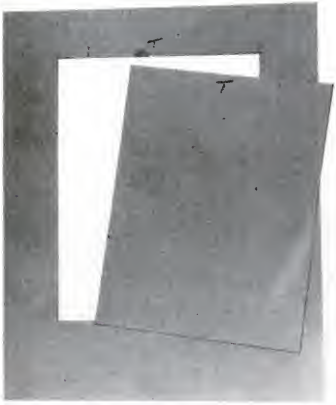
Frame a Photo with a Photo

By Shep Shepherd

EVERY amateur photographer sooner or later runs into the problem of thinking up new ways to display his favorite pictures. One dramatic way is to use photographic borders.

All you need, aside from the usual darkroom equipment, are two negatives, a cardboard mask, a ruler and a bottle of India ink. Although you can make any size print, I have found 11″ by 14″ the most pleasing and the easiest to handle. First, prepare the mask by cutting a 7″-by-

9½" rectangle from the center of an 11"-by-14" piece of cardboard, leaving 2" along both sides and the top and 2½" at the bottom. (The stiffener in a package of enlarging paper is excellent for the purpose.) Mark frame and cutout piece so that the latter can be replaced in the same position.



The border subject should have some relationship to the picture that is to be framed. A woven wire fence might be used for a picture of domestic animals. Tree bark would make a good border for birds or squirrels. An expanse of lace is appropriate for a picture of a bride.

Place the entire mask over a piece of plain white paper on the easel. Remove the border section, holding the center position, to compose and focus the border negative. Then substitute enlarging paper and make the border exposure.

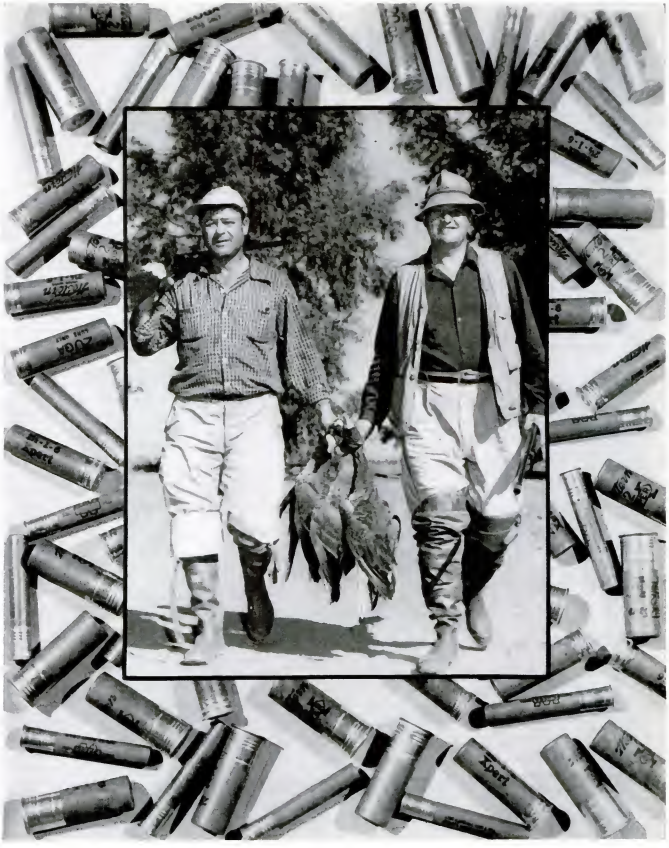
Return the enlarging paper to its light-proof container, remembering which is the top end. With plain paper in the easel and the border section of the mask over it, compose the subject negative. Then expose it on the same sheet of enlarging paper.

While photographically matted pictures are unusual in themselves, they can

THE TWO-PIECE MASK, at left, has marks along upper edges. Placed so, inner panel will match closely despite any errors in cutting.

ENLARGING EASEL aligns paper and mask even though both must be changed during the printing process. Mask openings may be ovals, diamonds or stars instead of a plain rectangle.

INDIA-INK BORDER, easily drawn with a ruler and a drafting pen, sets off the photo from its mat and conceals any small misalignments in use of the mask or overlaps in toning.



This hunting scene is appropriately framed with a close-up photo of some shotgun shells.

be made outstanding by selective toning with chemical toners sold in camera-supply stores. Following the simple directions given with the products, you can tone either the border section or the center subject. The part of the picture that is not to be toned should be covered with rubber cement brushed on the damp print. It can later be rubbed off with your fingers.

Ruled ink lines along the seams joining the subject picture and the border complete the operation. Use India ink and an A3 pen that makes a line about 1/16" wide. This will cover any unevenness in printing or toning. END

Old Containers Are Put to Work

USED coffee cups found around most garages and airports make handy containers for small parts during disassembly. If the parts and cups are to be stored away, a grease pencil is best for labeling the paraffined variety of containers.—*Bob Blatt, Larchmont, N.Y.*

Drills Can Be Used as Gauges

SINCE numbered drills are made of closely dimensioned stock, they can double as gauges. Here a No. 60 drill is being used to check the specified .040″ gap of a spark plug.

Other gaps such as valve push rods and timer points can also be checked with drills of suitable diameter. Any mechanic's handbook carries a table giving numbered drill diameters, running from .0135″ for a No. 80 drill to .2280″ for No. 1. Use only drills with rust-free, unmarred shanks.—*Elbert Robberson, Port Washington, N. Y.*

Metal Provides Door Clearance

A PIECE of scrap 20-gauge sheet metal about 1″ by 8″ added to the carpenter's toolbox can be used as a clearance gauge for fitting doors. It's just right for a tight fit. Carry a thicker piece for looser fits.—*Werner Kraatz, Santa Cruz, Calif.*

Hacksaw Blade Spreads Glue

A SCRAP of broken hacksaw blade will spread glue quickly over large, flat areas. The teeth let the glue flow easily but keep it to a smooth, even depth throughout.—*A. H. Waychoff, Phoenix, Ariz.*

Shield Catches Drill Chips

WHEN you drill into ceilings or other overhead spots, a tin-foil pie plate slipped over the bit will keep falling chips out of your eyes and off the floor. The soft foil won't mar the surface and cushions the drill if it suddenly punches through.—*M. C. Fleming, Pittsburgh, Pa.*

ROUGH TEST for a heat pump is provided by Linders' home—an eight-room house atop a windswept knoll in the Cleveland suburb of Westlake. That's Linders at right beside heat exchanger, where Freon gas warms air being blown into rooms. An electrical engineer, Linders designed unit.

I Heat My House with a Pump

Old Mother Earth provides heat in the winter, cooling air in the summer, for this owner-designed house without a furnace.

By John R. Linders

WHEN I built my home the mason insisted on tucking a furnace connection into the fireplace flue. He just couldn't accept the idea of a house without a furnace. Maybe he doesn't believe in my heat pump yet.

That was five cold and snowy winters ago. I still haven't got a furnace. And the house has stayed at a cozy 72°. The summers have been hot, as they usually are around Cleveland, but the thermometer indoors never goes above 70°. You see, I can also pump heat out. The same unit warms in winter and cools in summer. Total expense—for both heating and cooling—has been less than you'd expect just to heat a house this big.

The big advantage, though, is cleanliness. There's no dust and grease, which you'd be bound to get with even the best fuel-burning plant. My wife likes light colors. She bought a pair of pale-gray divans last year and the upholstery still is clean as new. The walls in the bedroom and bath have their original paint job, now five years old. There's not a streak of dirt to be seen.

"Refrigerating" Machinery Heats House

If you came down into my basement—which, incidentally, keeps remarkably dust- and dirt-free, too—you would see the secret of clean, inexpensive comfort. It looks like refrigeration machinery. And that's exactly what it is.

There is a three-horsepower motor,

"three-ton" compressor and a lot of copper tubing containing Freon refrigerant. Roughly, the system has some 20 times the capacity of a kitchen refrigerator.

You can see only a little of the copper tubing. There are 1,600 feet of it buried 5½ feet deep in trenches in the ground around the house. The Freon gas circulates through this network, picking up heat from the ground itself. Even in midwinter, the gas comes back into the house warmed up to around 40°.

Pressure Makes Gas Hot

The warm gas then goes to the compressor, which raises its pressure from 25 pounds to 120 pounds. When you compress a gas, you increase its temperature—you have probably noticed that when using a tire pump. The Freon gets up to 120°.

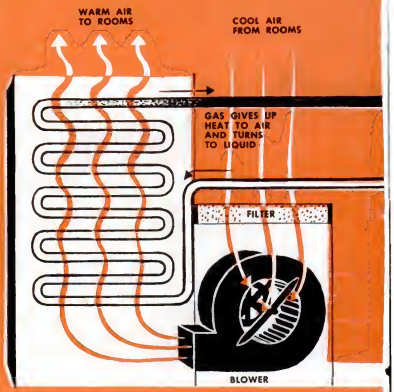
All I have to do then is blow air over the hot Freon coils and into the rooms. This is accompanied by a standard forced-air system, with ducts, blower and filters just like those in a gas or oil heating plant.

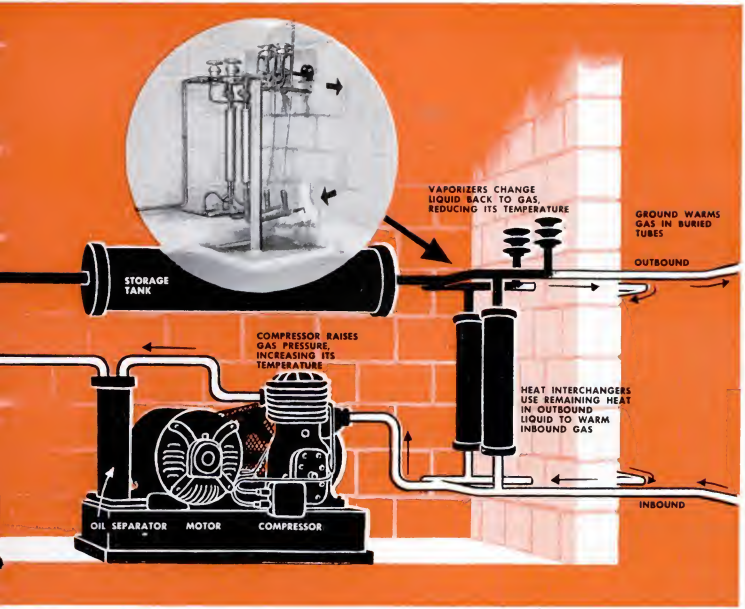
The Freon loses its heat to the air and changes into a liquid. The liquid flows to a vaporizer—a nozzle that squirts the liquid back into a gas and reduces its temperature to about 30°. Then the cold Freon is sent back outside to pick up more heat from the ground. In summer the system is simply reversed—the Freon is chilled by the ground, comes inside cold and absorbs heat from the house air.

The only expense is for electricity. I use a whale of a lot—around 1,500 kilowatt-hours a month—but that includes the freezer, refrigerator, kitchen range, hot-water heater, washing machine and clothes dryer, too. Because consumption is so high, the power company gives me a cheaper rate and my bill averages only $25 a month, for everything.

The heat pump saved money in the original cost of the house, too. If I had

HOW OUTDOOR COLD WARMS A HOUSE. The trick is to use energy (electricity) to make the cold object colder and move the extracted heat into the house, where it is added to the air. Linders' system (below) removes heat from the ground. Other types of heat pumps extract the heat from well water or, in milder climates, from the outside air itself.





wanted a conventional hot-air furnace, its chimney should properly have been placed smack in the middle of the house. That would have eaten up valuable living space and required relocation of the fireplace or a second chimney for it. The heat pump needs no chimney. I use the space for a built-in TV center, and my fireplace is where I want it: on an outside wall with its chimney outdoors.

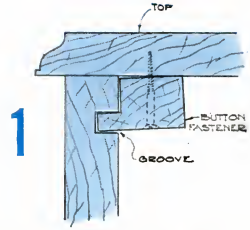
Casements Were Unnecessary Expense

I could have saved still more on construction costs. The house has casement windows with separate storm sash. But we rarely open them. Permanently sealed double-glass windows would be cheaper and more effective.

The only bug I had to get out of my heating plant was a slight amount of noise when the compressor started and stopped. Knocking out the concrete frame around the machine's cork mounting mat quieted it considerably. And the acoustical tile I am now putting on the basement ceiling should solve the problem completely. END

CLEANING BILLS are slashed by heat pump, which burns no fuel, can create no grease, smoke or dust. Above, Mrs. Linders shows off her drapes, cleaned but twice in five years.

8 Ways to Fasten a



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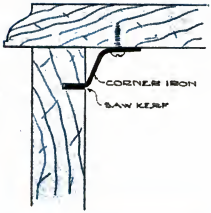

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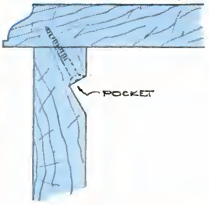

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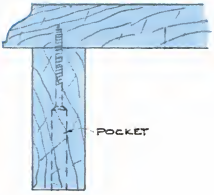

4

By William B. Eagan

ONE of the best ways to tell whether you are getting the most for your money when buying furniture is to look at the hidden parts—the sides and bottoms of drawers, the undersides of tables, the backs and tops of cabinets. One such place to look, and also a place where you, as a craftsman, must apply good woodworking practice if you are to produce the best construction, is in the fastening of furniture tops to side rails. There are two general methods, each with variations, for such fastenings. One allows for expansion and contraction of the wood; the other keeps the top stationary. The stationary fastener is usually employed where the top is of frame construction or made of laminated materials.

A fine example of the free-moving fastening is the button fastener in **Fig. 1.** The insides of the rails are grooved near the top before they are glued into place. Then wooden blocks are rabbeted on one end so that the tongues fit into the rail grooves and the other ends fasten to the top at intervals. Care must be taken in making the rabbets so that there will be a slight gap between the block and the top. Thus, when the screws are driven in the top the block will be pulled down hard upon the rail, yet will be free to move when shrinkage occurs.

A modification of the button fastener is a small piece of flat iron bent at right angles as in **Fig. 2.** One end fits into a saw kerf made on the inside of the rail and the other end is fastened to the top with wood screws.

In the stationary-fastener group, there are many variations. This group is more easily installed than the free-moving type. The pocket fastener, **Fig. 3,** is a good example of the stationary type, although it is just a bit more time-consuming to produce than others. Using a gimlet or twist bit, a hole is first bored down through the rail at a slight angle from the upper edge. Then a pocket is made for the screwhead by either boring a large hole

Table Top

How good a craftsman are you? The attachment method you pick for this job will reveal your ranking.

or cutting a recess with a gouge. The screw is then driven up from the inside into the top.

An equally satisfactory method of pocketing the mounting screw is shown in **Fig. 4.** A hole, large enough for the head of the screw, is bored part of the way through the rail with an auger bit, after which the remainder of the hole is bored with a small gimlet or twist bit and the screw inserted and drawn tight.

The most frequently used stationary fastener is the cleat type, seen in **Fig. 5.** It consists of ¾″ or ⅞″ square-section wood strips. These are fastened to both the top and rails. Holes are first bored and countersunk into the cleats at right angles to each other. The cleats are then screwed to the under surface of the top and the sides of the rails.

Probably the quickest to install and strongest stationary fastener is the corner iron, purchased at any hardware store for a dime or so, depending on size. The corner iron, **Fig. 6,** is a piece of metal bent in a right angle with two screw holes in each leg of the angle. It is simply screwed to the top and rails.

The dowel method, **Fig. 7,** is the kind usually found in Early American pieces. The top is secured by simply boring holes through the face and rails, and inserting dowels, which are sanded flush with the surface of the top. For a novel effect, dowels and top may be of contrasting woods.

Although nailing, **Fig. 8,** is the simplest method, it is not recommended for good furniture. However, it will serve its purpose for holding a temporary top or where it doesn't matter if the top eventually pulls loose.

In applying any of these fasteners, you should remember that you won't have a satisfactory job if the top and rails are not true. A fastener is never intended to act as a clamp for forcing the top down; it is merely a means of holding the top in place.

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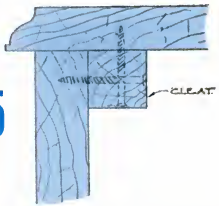

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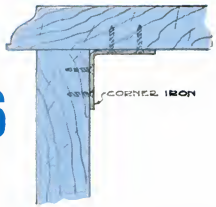

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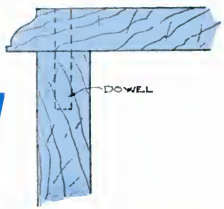


8

You can monogram your stationery, clamp light gluing jobs and make block prints with this easily built

Embossing Press

By Walter E. Burton

A THROWBACK to the old letter press, this midget will emboss initials, or any design you can shape from wire or carve, on ordinary paper and envelopes. Other uses include flattening photos and making linoleum-block or rubber-type prints.

Building the press. Use plywood for the base, platen and curved uprights. Cut the latter to the pattern on the next page and fasten to the base with glue and screws. Use the platen post (preferably solid hardwood) to gauge the placing of the upper guide strips, between which it should slide freely.

In mounting the cam, put washers on each side if necessary to make it turn with some friction. Lock the pivot nut by heading the bolt over it lightly. Lubricate cam and post head with soap.

Brad on two clips cut from tin plate or sheet aluminum to keep the lower end of the post within the guides. Turn in wood screws to anchor the springs, cutting these to length by trial.

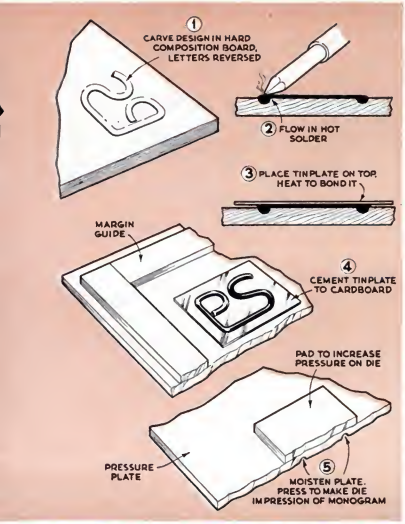
How to emboss. Some costume jew-

A FLICK OF THE WRIST transforms plain paper into embossed stationery. This plywood press can turn out such sheets by the hundred. Paper is moistened slightly, placed in a cardboard book that has a die cemented to one leaf (above left), pressed and allowed to dry.

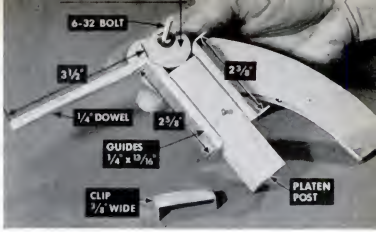
elry can be used as embossing dies. You can shape designs from wire, or cast them in a carved mold, using soft solder.

Note paper is most easily embossed in a "book" having the die in the lower leaf and a matching impression in the upper leaf. The carved mold made for a cast die can be used for the top leaf. If cardboard is used, moisten it and squeeze the die in with a vise. Hinge the leaves together with cloth tape and cement the die to the lower leaf in register with the impression. Glue on cardboard stops for locating the sheets to be embossed.

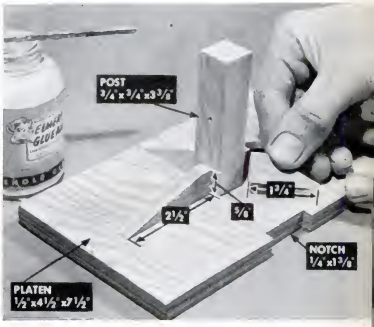
Printing with the press. Platen travel being small, the printing block must be thin. Cement the linoleum or rubber type to a sheet of metal larger than the platen, and bend its edges over the platen. Roll ink on another sheet of metal, glass or plastic, insert it in the press, and squeeze down the block to transfer the ink to it.



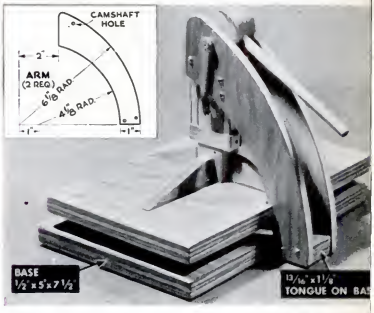
DIES CAN BE MADE by casting solder in a carved mold like this. It may be advisable to cut a shallow recess in the lower plate so that the tin-plate base of the die may be set in. Buttons and jewelry may be used as dies.



CAM ACTION forces the platen post down as the handle is swung to the horizontal. Spot the pivot hole about ¾" from the outside of the front guide strip and at a height to force the cam down on the post even when the platen rests on the base. Shaft is a 6-32 bolt.



FASTEN POST TO PLATEN with glue and a single wood screw. Then glue on braces as shown. The notch embraces the sidepieces, which are glued and screwed to a tongue at the rear of the base as in the photo below. At the top, the curved arms are bridged by the post guides. Metal clips at the bottom of these help retain the post. Two springs pull the platen up.



Here's How to Make Picture Frames Without Joints

PENNIES pay for these good-looking plywood photo mounts, and there isn't a joint in a carload. They are just solid pieces of plywood with beveled edges.

Saw so that the front face of the mount is ⅛" larger all around than the print. Round off sharper corners with sandpaper and sand the bevels smooth. Apply clear lacquer or resin sealer all over.

When this is dry, sand lightly and apply undercoat. This can be wiped off the bevels to leave the plies visible for a decorative effect. A second coat that contrasts with the undercoat produces a two-toned finish when wiped off while tacky. Wipe only the bevels, leaving solid color in the print margin.—*Mac L. Olds, Tacoma, Wash.*

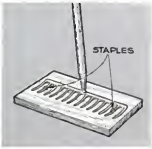
TO MOUNT PHOTO apply thin coat of rubber cement to front of "frame" and back of print. Let dry thoroughly. Center print carefully as you drop it into place, for it cannot be shifted once in contact. Rub hard with soft cloth. Turn a screw eye into back for hanging.

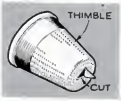
You Can Mix Plaster in a Ball

HALF of a hollow rubber ball makes a good container for mixing small amounts of patching plaster, for it is easily cleaned. Squeeze the ball and any plaster that has hardened too much for use will break away.—*J. M. Finn, Pittstown, N. J.*

Tamper Assembled Quickly

A HANDY tamper for cement or lawn work can be put together in a jiffy by stapling a garden rake to a block of wood.—*Roland E. McCune, Harvard, Mass.*





Thimble Cutter

THIS thread cutter, made from a dime-store thimble, enables my wife to rip out stitches fast. Cut a small triangle in the end of the thimble, bend it out and file the edges sharp.—*William B. Eagan, Louisville, Ky.*

How to Patch Tubeless Tires

Kits make it easy. They include a gun that you can also use to repair small punctures in regular tires.

SOON you may find yourself out on the road face to face with a punctured tubeless tire. They will be standard equipment on many 1955 cars.

A tubeless tire isn't necessarily punctureproof. Some makes have no special inner layer of sealing compound to "heal over" small punctures. And even those makes that do have an inner sealer can be punctured in such a way that they may develop a leak.

The tire makers have brought out two kinds of repair kits: professional kits, containing materials for various repairs, and smaller kits designed for motorists and intended only for fixing small punctures. The latter sell for less than three bucks.

Although the kits vary as to contents, and the step-by-step instructions that are included differ slightly, the basic procedures are similar.

Small punctures, like those you get from a small nail (no bigger than 1/16-inch diameter), usually can be repaired without removing the wheel or the tire. A special tire-sealer gun that looks like a screw-type grease gun is used to force a tire-sealing compound into the puncture hole. All kits contain one of these guns.

You jack up the car until the wheel can spin. Then you locate the leak by turning the wheel and watching for bubbles while water flows over the tire. Mark the puncture and wipe the tire dry.

Reduce the tire pressure to five pounds. Remove whatever caused the puncture and clean out the hole, taking care not to enlarge it. Then, following instructions provided with your gun, turn the screw handle to force the tire-sealing compound into the puncture hole.

After about 20 minutes you can re-

Small punctures can be fixed by using a tire-sealer gun to force sealing compound into hole.

LARGE PROFESSIONAL KIT for the repair of tubeless tires contains a large tire-sealer gun, two cartridges of sealing compound for the gun, sealant patches, rubber solvent, rat-tail file, plug-threading needle, six rubber repair plugs and a knife. Kits of this type, intended primarily for commercial tire repairmen but available to any motorist, cost less than $10.

inflate the tire to the standard pressure, lower the jack and drive off.

The tire-sealer gun also can be used in the same way, one manufacturer claims, to repair small punctures in conventional tires with tubes right on the road, without removing the tire or the wheel. The tire-sealing compound does its job on both tire and tube.

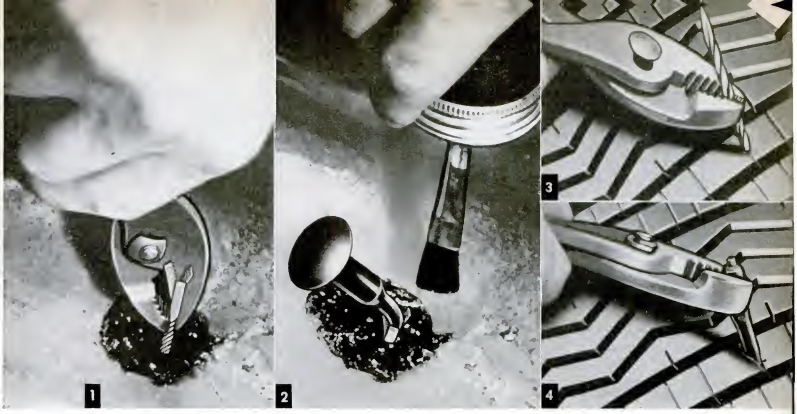
Medium-size punctures (no larger than 3/16 or ¼ inch) can be repaired with tire-sealing plugs that are provided in the professional kits. Since this work is done from the inside, the tire must be removed from the wheel.

Cold-patch repair. An ordinary cold patch also can be used to repair a puncture in a tubeless tire that doesn't have the inner layer of sealing compound, or in an unprotected area of a self-sealing tire. After the tire is removed, the puncture hole is cleaned, then filled with sealing compound from the tire-sealer gun. The cold patch then is applied to the inner wall in the regular way.

A hot-patch repair can be used on

HOT-PATCH REPAIR requires the use of a special hot-patch clamp designed for use with tubeless tires. The clamp's jaws are elongated to fit around the sidewall of the tire.

TIRE-SEALER GUNS FOR MOTORISTS are smaller versions of the large professional guns. This one, made of plastic, comes filled with sealing compound and sells for less than $1.50.



HOW TO USE A RUBBER REPAIR PLUG. First, plug-threading needle is inserted in puncture from inside (1). After stem of plug is attached to needle by squeezing metal fingers together, plug is coated with solvent (2). Then needle and stem are pulled through from outside (3) until plug's head is tight against tire's inner wall (4). Finally, stem is trimmed flush.

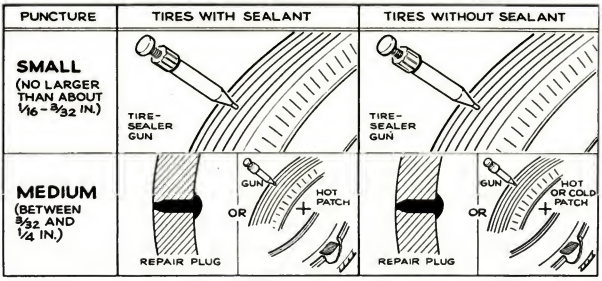
both types of tubeless tires—those with the inner layer of sealer and those without it. The tire-sealer gun is first used to fill the puncture hole and then the conventional hot patch is applied. But a special hot-patch clamp designed for use with tubeless tires is required to hold the patch in place.

Warning: Any puncture that doesn't "heal itself" in a tire having an inner self-sealing layer may indicate internal injuries that should be repaired. This can be done by carefully cutting away the injured portion and applying a patch of special sealer material.

Leaks can also be caused by loose rim rivets. They should be tightened by peening over their heads with a hammer. If this doesn't cure the leak, each rivet should be coated with rim-rivet cement.

Some tubeless tires are fitted with a safety diaphragm. This does not quite fill the tire. After repairing a puncture, inspect this diaphragm. If it shows any kind of a cut or bruise, it should be replaced by a new one. END

REPAIRING TUBELESS TIRES



FOR YOUR *POPULAR SCIENCE MONTHLY* INFORMATION FILE

Magazine Patches Tire Boot

CAUGHT with a bad hole in one of our tires and no spare to switch to, we saved the day with this trick. To keep the tire from blowing the tube, we removed the casing and stuffed a folded magazine between tire and tube. When we got to the nearest service station, the tire was gone, but the tube and about 10 pages of the magazine were still intact.—*Stanley Clark, E. Bradenton, Fla.*

Wire Helps Chuck Small Drill

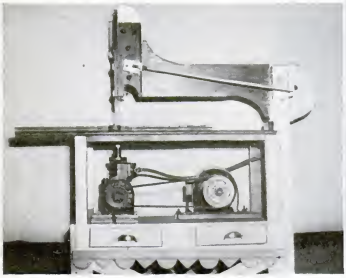
THE chuck of the usual carpenter's brace will not grip twist drills smaller than about ⅛". A few turns of fine copper wire around the shank of the drill may provide enough bulk for the chuck to hold.—*Elbert Robberson, Port Washington, N.Y.*

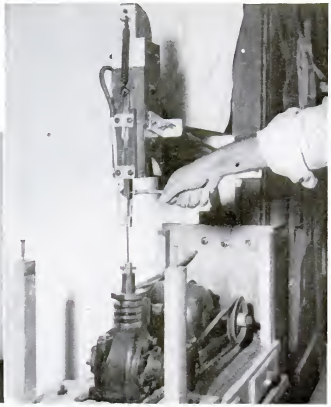
Wrench Becomes Bending Tool

AN OLD monkey wrench makes a handy bender for strap iron up to 3/16" thick. Grind or file the insides of both jaws round and adjust the movable jaw to a close fit on the stock. To form scrolls, start at the inside and work your way around, bending a very little at a time.—*Floyd McGuckin, Ridgewood, N. J.*

Piston Head of Old Compressor Pumps His Scroll Saw

GRIPPED in a holder attached to the piston head of an old compressor, saw blades whip out fancy cuts in jig time on Joseph Pera's homemade scroll saw. Pera, who lives in East Paterson, N. J., added a neat touch by coupling a sawdust blower to the compressor's output valve.



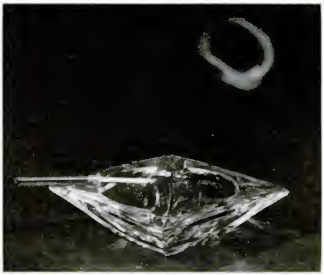


Trick Cigarettes Smoke Themselves

IF YOU'RE looking for a new stunt to amaze your friends, you'll find these novel cigarettes just the thing; light them once and they'll continue puffing smoke rings by themselves.

They can be used in many startling ways. Punch a hole in the mouth of a portrait photograph, insert one of the cigarettes, light it, and watch your friends' eyes pop in astonishment as the photograph apparently blows smoke rings from the cigarette.

On holidays or special celebrations the cigarettes can be combined with other novelties. For example, at Christmas you might insert them in the mouths of miniature plastic snowmen and use them for table decorations. Once you start, you'll find there's no limit to the number of applications.—*Ken Murray, Colon, Mich.*



MINIATURE CIGARETTE in miniature holder will puff rings down to the end. Soft, unglazed cigarette papers burn best. The finished cigarette should have a diameter approximately the size of a toothpick. A narrow band of colored paper at one end simulates a cork tip.

THE INGREDIENT that takes the place of tobacco is celluloid. Cut sheet celluloid into narrow strips. Gather four or five strips in a bundle and cement with acetone. Cut bundle into sections, each section as long as a cigarette, then roll tightly in cigarette paper. Wetting starting edge of paper helps cigarette roll easily.

Building your own gives you

Two Beds for the Price of One

By John Rogers

JUST because you spend a third of your life in bed doesn't mean that it should cost you a fortune to do it comfortably. I saved at least half the price of a pair of modern twin beds by building my own frames to support store-bought springs and mattresses. So I figure I got two beds for what one would have cost. And I got an extra dividend: I can knock them apart for easy moving or storing by loosening six bolts and a few screws.

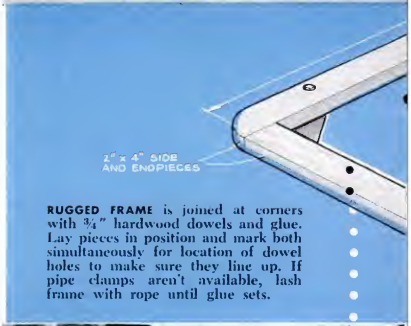
The entire frames are made from inexpensive two-by-four pine. Dimensions shown are for standard twin-bed box springs, but be sure to measure your own first, as sizes do vary slightly. The front corners are rounded for a pleasing appearance and to prevent whacking your shins against sharp points.

The one small luxury is ¼" pine-veneered plywood for the headboards, but it's well worth it since these are the main parts that show. You can cut both panels out of a 3'-by-6' sheet (this less-expensive size is now available), with plenty left over for the gusset braces.

The plywood matches the rest of the bed and is framed with grooved 1½"-by-1¼" pine strips that give it the rich, solid look of much heavier wood. Attach the strips with glue, brushed lightly into the grooves so it won't ooze out over the veneer, and clamp or tie until dry. The upper corners are mitered for appearance and the lower ones lap-jointed for strength.

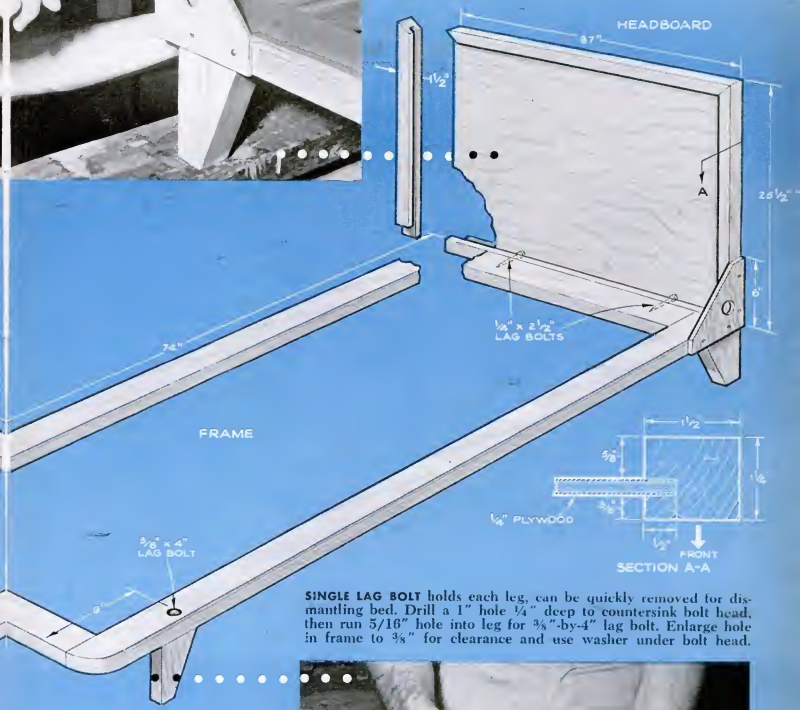
I gave my beds a handsome natural finish by simply sanding and applying clear lacquer.

Two-by-fours and plywood make sturdy, inexpensive bedframes that you can even take apart.



RUGGED FRAME is joined at corners with ¾" hardwood dowels and glue. Lay pieces in position and mark both simultaneously for location of dowel holes to make sure they line up. If pipe clamps aren't available, lash frame with rope until glue sets.

PLYWOOD GUSSETS hold the headboard rigidly to the frame. Two ¼"-by-2½" lag bolts fasten the headboard from the rear. Attach the gussets with screws only, for easy removal. Their center hole is strictly for looks.



SINGLE LAG BOLT holds each leg, can be quickly removed for dismantling bed. Drill a 1" hole ¼" deep to countersink bolt head, then run 5/16" hole into leg for ⅜"-by-4" lag bolt. Enlarge hole in frame to ⅜" for clearance and use washer under bolt head.

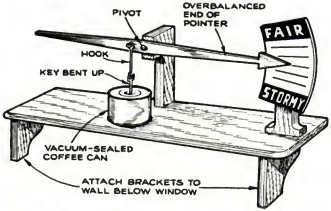
LEG DETAIL

Beverage Cans Serve as Markers

Reflective markers for a driveway or airstrip can be easily made by wrapping reflective tape around beverage cans mounted on wood stakes about 30″ high.—*Bob Blatt, Larchmont, N. Y.*

Shellac Retards Rust on Bolts

When temporary bolts are being installed where rusting may occur, such as in scaffolding or form work, dip the threads in shellac before turning up the nuts. The shellac will retard the formation of rust, making subsequent nut removal easy.—*Gilbert C. Close, Hawthorne, Calif.*

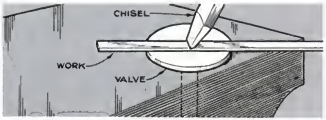


Coffee Can Forecasts Weather

If the price of java goes much higher I may lose my barometer, because its main part is an unopened coffee can. The vacuum seal makes the head of the can respond to any change in atmospheric pressure. This diaphragm action is carried to a long pointer by a hook passing through the key—which I carefully bent vertical—attached to the lid. The nearly balanced pointer (its arrowhead end is slightly heavier) gives readings on a calibrated sign. Low atmospheric pressure makes the arrow dip; high pressure raises it to Fair.—*Walter Archer, Billings, Mont.*

Brush Catches Grinder Dust

A wet brush placed under your grinding wheel will collect most of the flying abrasive grit, preventing it from getting into tool bearings and damaging them. The brush can be easily cleaned when dry by tapping it briskly into a waste pail.



Auto Valve Saves Vise Anvil

You can keep the face of a vise anvil from being nicked by inserting an auto-engine valve in the hardy hole.

The hard, flat valve head makes a tough back-up surface for cutting through metal with a cold chisel.—*Howard E. Moody, Upper Jay, N. Y.*

Kitchen Switch Starts My Car

After I close a circuit running to the garage, my engine warms up as I eat breakfast. She's rarin' to go when I take off for work.

By Julian M. Sienkiewicz

IT'S a familiar dilemma: warming up the engine on a cold morning takes time when time is short; but starting out with a warm engine and heater is much better for the engine, and a whale of a lot more comfortable.

All done by buttons. My remote-control rig lets me start the engine from the kitchen. The car warms up while I have breakfast. When I go out to the garage, she's ready to roll. Two protective devices prevent mischances. An automatic warning light on the dash tells me not to drive off with the remote-control wires plugged in. And a "lurch" switch immediately kills the engine if, accidentally, the car has been left in gear.

The idea can be applied to any car having an automatic choke. In no way will it interfere with normal operation. The circuit shown is suited to a manual-transmission car with push-button starting, but minor changes will suit it to others.

In the house. The remote-control unit is very simple: a toggle switch to turn on the ignition, a normally open push button to work the starter relay, and a pilot light to signal that the engine is running. These are mounted in a ply-

wood box, and their six wires run in weatherproof cable out to the garage. For a quick disconnect at the car, I use a multiple connector, concealed under the gas-filler lid.

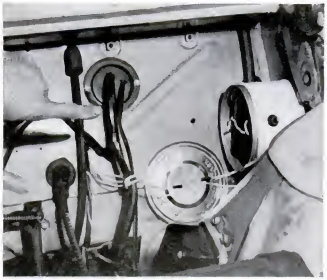
The circuitry is simpler than you might think. The ignition toggle is wired as a shunt to the car's ignition switch, and the starter button as a shunt to the car's starter button. So when in the kitchen you flip on the ignition and press the starter, the car behaves exactly as though you were out there doing it in person. The "engine on" lamp is connected to the generator and ground, so that the instant the engine catches, the bulb lights up to tell you. If the engine should stall, the light will report that, too.

No lurching allowed. The lurch switch and relay may not actually be necessary, but are an investment in peace of mind. If the car *should* be left in gear, it will not travel six inches before both the starting and ignition circuits are cut off. I tried it.

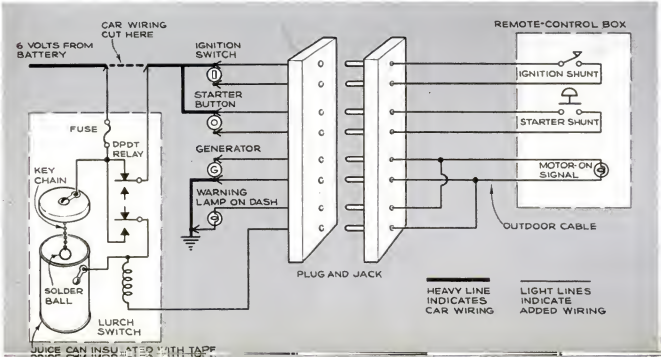
A key chain, with a ball of solder at the end, is suspended inside a small, upright tin can. If the car lurches forward or backward, the ball touches the can wall, energizing a protective holding relay. This cuts the ignition and starting circuits and holds them open until the connector is pulled off.

You'll notice there's a by-product advantage, too: If I should ignore the dashboard warning lamp and try to drive off with the connector still on, the lurch switch would stop me in inches. In the evening, I plug in and check to see that the kitchen ignition switch is off.

ONLY SECONDS are needed to plug in the connection at night or unplug it in morning. In the morning, the ignition key is turned on before disconnection in order to keep the motor running.

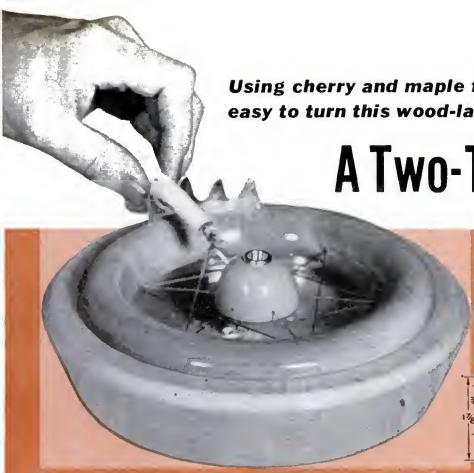


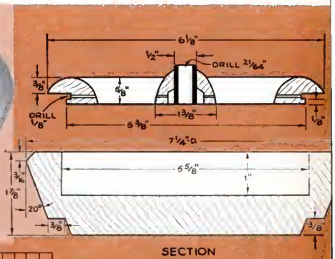
LURCH SWITCH AND RELAY, which make sure the car cannot take off on its own, are housed inside a coffee can mounted in the engine compartment. A 10-amp. fuse guards the system.

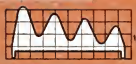


Using cherry and maple for contrast, it's easy to turn this wood-lathe gift project:

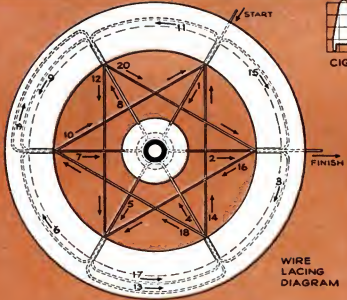
A Two-Tone Ash Tray







CIGARETTE REST



LAY OUT SIX EQUAL SPACES on the knock and ring, use a 1/16" drill for the pipe-knock wire holes and a 1/8" drill for ring holes. Shine up about 6' of suitable brass wire and lace it as shown, following the numbers. The ends can be pushed into the slot around rings.

CIGARETTE REST, cut from 1/16" sheet brass, has two small legs for pushing into holes in the ring. Tack the rest to wood as shown here for buffing. Finish the project with three coats of brushing lacquer and rub well with fine steel wool between each coat.

THREE TURNINGS are required—a maple bowl and pipe knock and a cherry (or walnut) ring. Bowl is turned to suit a standard petri dish 20 mm. deep and 150 mm. in diameter. These are available from laboratory-supply houses. A glass ash tray of similar size could be substituted and the bowl dimensions adjusted to suit. Drill the pipe knock 1/2" for the push-fit brass bushing that serves as a snuffer. Counterbore knock to make wiring easier.

12 USES FOR Glass Jars

PLANT STARTER

COVER FOR OUTDOOR LIGHT

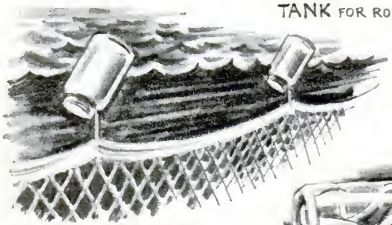
HANDY TAMPER

FILL LARGE JAR WITH CONCRETE, BREAK OFF GLASS WHEN SET

LONG-BURNING CANDLE

EMERGENCY DEVELOPING TANK FOR ROLL FILM

VASE- WRAP WITH COLORED CORD, MELT WAX CRAYONS FOR MOTTLED PATTERN, APPLY DECALS, ETC.



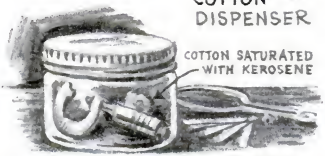
FISH-NET FLOATS

GOGGLE HOLDER IN SHOP

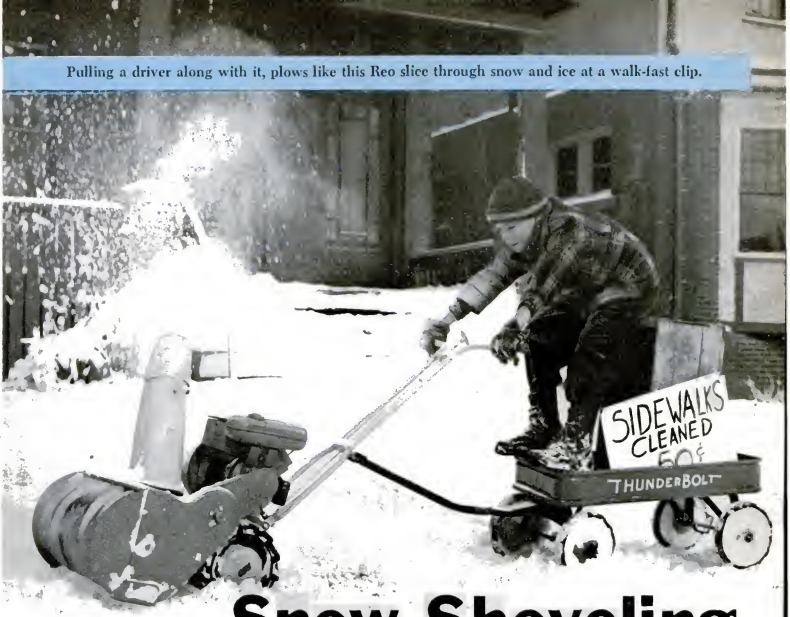
COTTON DISPENSER

GLUE DISPENSER

KNITTING-YARN HOLDER



RUSTPROOF CONTAINER. FOR PRECISION TOOLS



Pulling a driver along with it, plows like this Reo slice through snow and ice at a walk-fast clip.

Snow Shoveling Is Easier Now

A stroll behind one of the new home-size rotary plows quickly clears your sidewalk. Here's what you can expect them to do.

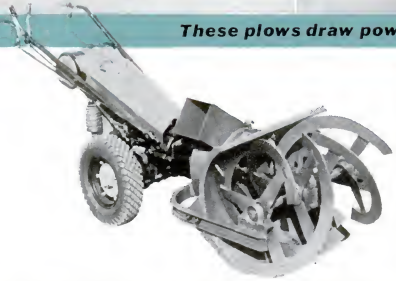
By Stanley Beitler

SNAZZY, power snow movers that literally blow snow away are replacing the old wooden-handled snow shovel. Their rotors churn up the snow and throw it aside at an average clip of 100 cu. ft. per minute. That's a lot of shovelfuls.

This wintertime counterpart of the power mower has come into its own at about the same cost. It whirs through all kinds of snow on gravel, cement, crushed rock or blacktop. A swivel chute directs the snow where you want it.

You have to push some of the new snow-removal machines. The power unit just drives the rotor. Others are self-propelled. Power usually is supplied by a one-cylinder gasoline engine, although

These plows draw power from a garden tractor



ADD ONE OF THESE ATTACHMENTS to a garden tractor and you have a rotary snow mover. Simplicity model (above left) cuts a 26" swath 20" deep, has a control on handle to rotate snow chute. Bolens makes two sizes, a 17" for their small tractor and a 25" (above right) for their largest. Gravely attachment (left) has both reel to draw snow in and blower to throw it as far as 30 feet. Plow is gear-driven directly from nose drive on tractor. Other accessories are blade and rotating brush.

there is at least one electric unit on the market. Prices range from less than $100 to around $225. Most units cut a swath from 16" to 20" wide, 18" deep, and throw normal snow from 15 to 30 feet.

Some manufacturers offer snow-moving units that can be attached to small garden tractors. You can also buy accessories such as a rotary brush, snow-dozer blade, drift cutter, and sulky.

Powered plows have two basic ways of getting rid of snow. In one, found mostly on push models, a bladed rotor is driven directly by the engine shaft. The blades, spinning at right angles to the direction of travel, pick up snow and hurl it to the side by centrifugal force.

In the other type, more common to self-propelled plows, spiral blades looking something like a mower reel are chain-driven by a sprocket on the wheel axle, which is in turn chain-driven by the engine. The blades, turning in the direction of travel, scoop in snow and force it out the ejection chute much like a screw conveyor.

There's one precaution for owners of powered snowplows: Keep a careful eye on Junior. Or the enterprising lad will be out cleaning up around the neighborhood at 50 cents a throw. Your own pathways will get done last.

Further information about the snowplows shown here can be obtained from: Bolens Products Div., Food Machinery & Chemical Corp., Port Washington, Wis.; Gravely Tractors, Inc., Dunbar, W. Va.; Jacobsen Mfg. Co., Lorsen & Thomas, Racine, Wis.; Pioneer Gen-E-Motor Corp., 5841 W. Dickens Ave., Chicago; Reo Motors, Inc., Lansing, Mich.; Sensation Mower, Inc., 7577 Burlington St., Ralston, Nebr.; Simplicity Mfg. Co., Port Washington, Wis.; Toro Mfg. Corp., 3042 Snelling Ave., Minneapolis; Western Tool & Stamping Co., 2725 Second Ave., Des Moines, Iowa.

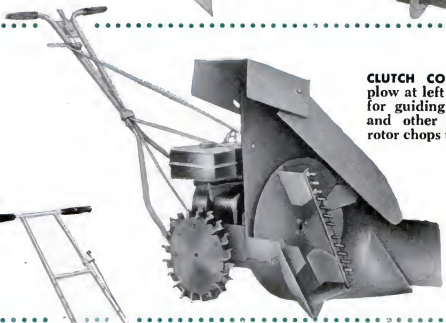
It Beats Shoveling!

WHILE living at the end of a long country lane, impassable after a snowfall, we had a standing order with a coal company to send us a ton of coal each time it snowed. After their dual-wheeled truck had pulled into and backed out of the lane, we could easily follow the tracks until the next snow fell.—*Henry Josephs, Gardenville, Pa.*

These plows are self-powered, but use different drives

ELECTRIC PLOW plugs into any nearby outlet, can be converted to mower by using ½-hp. motor to run rotary grass cutter. This Sensation unit has paddle-wheel blade and a 100′ cord.

SPIRAL BLADES on this Toro plow channel snow in and up center chute like a conveyor screw. Available in both powered and push models, it has heater to keep carburetor from icing.



CLUTCH CONTROL on Western Tool plow at left lets you disengage wheels for guiding it by hand around trees and other difficult objects. Bar on rotor chops up ice before it hits blades.

EGG-BEATER BLADES whip up snow like a milkshake in the Pioneer model below. Teeter-totter chute on top channels snow to either side. Wheel height adjusts to clear smooth or rough turf.

BABY OF THE BUNCH, the push-it-yourself Jacobsen plow above weighs only 82 lb., has a 1½-hp. engine, yet will clear away 85 sq. ft. of snow up to 10″ thick in one minute. END

Storage Cabinet Sorts Parts

LIKE most home craftsmen, I stock too many kinds of screws, bolts, nuts and washers for specialized storage. To get at the ones I want quickly I built a special sorting tray. I store nearly alike parts in one of two dozen glass jars, which are threaded into metal tops attached to the underside of the shelves in a cabinet.

Removing a jar, I dump its contents into the sloping tray, which hinges down from the front of the cabinet. After collecting the needed parts, I brush the rest of the assortment forward between converging strips of molding to a hole at the front of the tray. There they tumble into another glass jar, attached to a ring-type jar top. I put this jar back in the cabinet and attach the newly emptied one to the tray.—*Carlton A. Burmeister, Toledo, Ohio.*

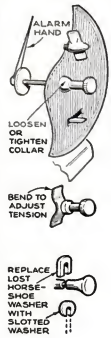
How to Cut Replacement Glass

IF A piece of glass used as a pattern to cut a duplicate or replacement slips on the work, a poor fit or a spoiled piece may result. Four pieces of common friction tape placed between the two sheets, near the corners, will keep the glass from slipping.—*Harvey Muller, Danboro, Pa.*

Idle Hands Can Be Put to Work

IF THE alarm hand on a spring-wind clock is too tight to turn or too loose to stay put, you can still wake up on time.

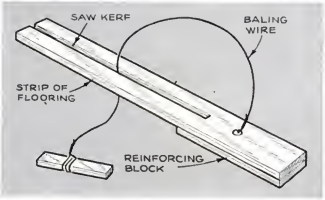
Three types of tension adjustments are commonly used. One (top right), has a threaded collar; screw in to tighten, out to loosen. The second type (center) has a spring leaf. Curve it for more tension, flatten it for less. The third (bottom) is a horseshoe washer that frequently gets broken or lost. Make a new one by slotting one side of an ordinary washer.—*W. Schopp, Philadelphia.*



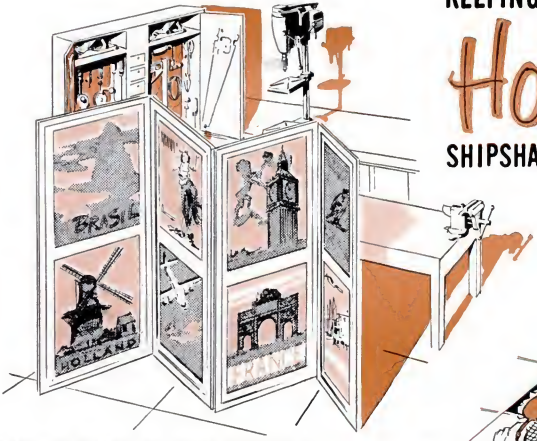
Wire in Slot Cuts Insulation

A FAST cutter for pads of insulation, devised by Bob Kenney of Townsend, Mont., is shown below. It's nothing more than a piece of baling wire and a length of flooring with a slot cut in it.

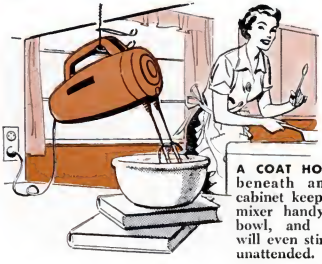
For use, the board is placed over the insulation and the wire under it. The ends are held with the feet. Pulling the baling wire makes a quick, clean cut.—*E. V. Reyner, Townsend, Mont.*



KEEPING THE Home SHIPSHAPE



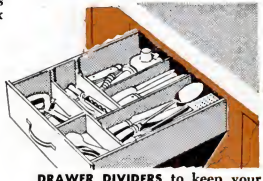
A FOLDING SCREEN will hide a workbench in a basement playroom. Use 2'-by-6' plywood panels on rectangular frames. Decorate with travel posters coated with shellac.



A COAT HOOK screwed beneath an overhead cabinet keeps a portable mixer handy. Raise the bowl, and the beaters will even stir a light mix unattended.

WHEN ADDING A CELLAR CEILING, be sure to plug up any openings around pipes with a fireproof fill. Crushed concrete, brick, plaster or gypsum block held up by metal mesh nailed to the wood will seal off fire.

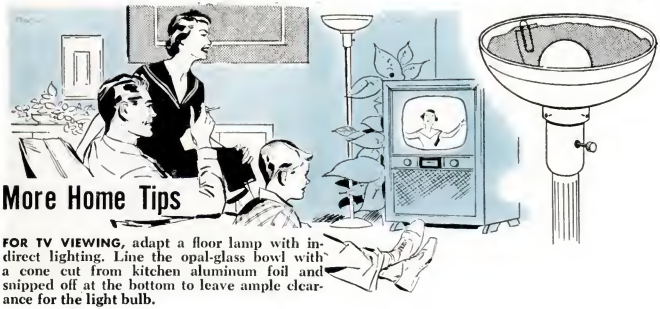
A SWINGING DOOR won't be marred by scuffs if a rubber stair pad is tacked on at foot level.



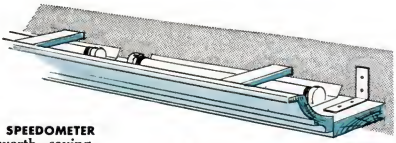
DRAWER DIVIDERS to keep your kitchen tools sorted can be neatly installed if the drawer bottom is removed and dadoes are cut in the sides to take partitioning. Fasten dividers at rear and sides with nails.

Please turn the page for more home tips.

More Home Tips

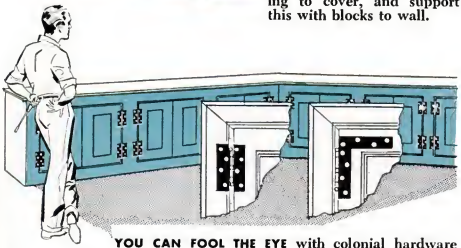


FOR TV VIEWING, adapt a floor lamp with indirect lighting. Line the opal-glass bowl with a cone cut from kitchen aluminum foil and snipped off at the bottom to leave ample clearance for the light bulb.



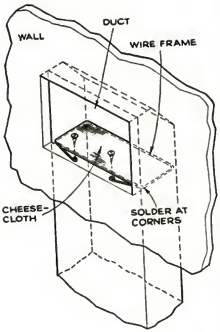
A CORNICE for indirect lighting is easy to build with crown molding. Install fluorescent fixtures on one-by-threes fixed to the wall with corner irons, nail on molding to cover, and support this with blocks to wall.

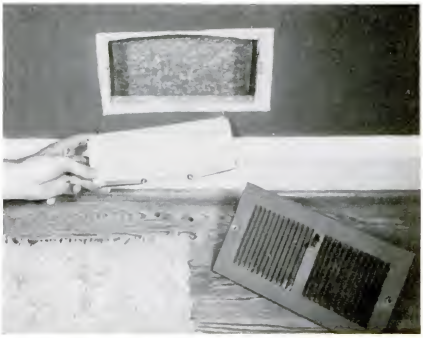
A BROKEN SPEEDOMETER CABLE is worth saving. Add it to your tool kit and you have a close approximation of a plumber's snake. It is just flexible enough to unclog a stopped drain.



YOU CAN FOOL THE EYE with colonial hardware made of steel mending plates painted to look like wrought iron. Fasten the plates flush with the present hinges, using heavy upholsterer's tacks with antique-finished nails.

A CACHE OF MATCHES can be kept handy at your outdoor incinerator. Just nail the lid of a small jar to the underside of a nearby fence rail.





Filters in Warm-Air Heating Ducts Help Keep House Clean

DUST from our forced-hot-air furnace was a real nuisance—even though I kept the big glass-wool filter clean—until I added this extra filter to each room register. Since fastening the filter to the register grille would interfere with the damper, I mounted it flat across the duct.

The bent-wire frame, made from two pieces of coat hanger, is covered with two layers of fine cheesecloth—the kind sold to polish cars. Two prongs in front are bent to form eyes and screwed to the wood frame around the register opening.—*John G. Voelker, Towson, Md.*

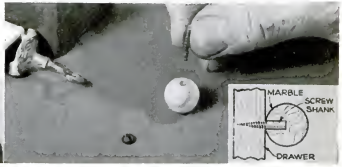
Drilled Marble Makes Neat Drawer Pull

A COLORED "aggie" or glass marble makes a novel but quite practical drawer pull for modern as well as colonial furnishings. It can be used on small cupboard or shelf doors, too.

Converting the marble to a knob calls for drilling a hole ¼" to ⅜" deep in it. To hold the marble for drilling, wrap adhesive tape around it and clamp it in a vise or in a lathe chuck laid flat on the drill-press table. Avoid excessive clamping pressure by placing a bolt under it to resist drilling thrust, as shown in the photo.

Another way is to bore a hole in a block of wood, making the hole small enough to be a drive fit for the marble.—*Walter E. Burton, Akron, Ohio.*

TO DRILL THE MARBLE, flatten the top with a stone or fine file wet with turpentine. Then build a dam of modeling clay around the spot. Put in No. 150 silicon-carbide grains and a few drops of turpentine. The drill is ⅛" brass rod or tubing. Use medium speed, lifting the rod often to let the abrasive mixture flow beneath.



AFTER DRILLING THE HOLE, clean out all grit and turpentine with acetone, alcohol or other evaporative solvent. Cut the head off a wood screw whose shank fits the hole snugly. Roughen the shank by filing to give the cement a better grip. Turn the screw into the drawer front and cement on the marble.

One Evening Plastic Projects

A twisted strip forms the socket of this smartly simple candleholder. From clear 3/16″ stock, rip a ¾″-wide strip 24″ long (for a short socket, 15″ is sufficient). Sand the edges smooth, and round both ends. Heat in an oven until soft.

With gloved hands, hold one end firmly on a piece of ¾″ dowel. Quickly wind two to five close turns. Give the last 4″ a quarter twist, and form the handle loop. Hold until cool.

Holding the shaped spiral upright, rub the bottom and handle on sandpaper to form flat cementing areas. Bevel and polish the edges of a 4″ square of ⅛″ or 3/16″ black or colored sheet plastic, and cement the socket securely to it.

Poured-on patterns create striking push plates or switch plates, the design becoming part of the surface. Clear or colored Plexiglas may be used.

For the coating, you need ethylene dichloride solvent and pearl, gold, silver or bronze powder (available at art-supply stores). Cut the plastic to size and sand or buff the edges, as preferred. Then remove the masking paper and sand one face to create a textured surface.

Add bronzing powder to ethylene dichloride. Then dissolve in it one third its weight of Plexiglas sawdust or chips. Pour a trickle of the mixture onto the sanded surface, keeping well inside the edges. Leave in a dust-free spot to harden.

DOOR-PUSH PLATE

BELT SANDING produces frosted effect on right side of this panel, hand sanding strandlike lines on left side. Pattern at left below is made by pouring from a paper cup with a corner snipped off. For swirl design at right below, flow coatings of two colors on thickly. Tilt panel to blend them into random patterns.

Projects shown here were adapted from the books Plastics for the Home Craftsman, *by Harry Walton, published by McGraw-Hill Book Co., 330 W. 42nd St., NYC; and* Plexiglas Craftsman's Handbook, *published by Thos. Y. Crowell Co., 432 4th Ave., NYC.*

THIS DOWEL JIG enables you to shape a square of plastic into a decorative dish in less than a minute. If embossed stock is used, shape with textured surface down, leaving inside smooth. Set oven temperature at 275° for type 1-A, 325° for type II (heat-resistant) Plexiglas.

From oven to dish in 30 seconds is the record for this table piece. To make the bending jig, draw a 9½" square on a piece of wood, mark 1¾" both ways from each corner, drill ⅜" holes, and drive in short pieces of ⅜" dowel.

Sand the edges of a 12"-square sheet of ⅛" or 3/16" sheet Plexiglas smooth. Remove the masking paper and hang the sheet from an oven grate with clips or clothespins. Heat until limp. Then, wearing cotton gloves to protect your hands, place it squarely on the dowels and pinch each corner down between two of them. Gently press the center of the sheet down flat. If the corners are not neat, reheat the sheet and try again.

Leave the finished dish in the bending jig until it has cooled.

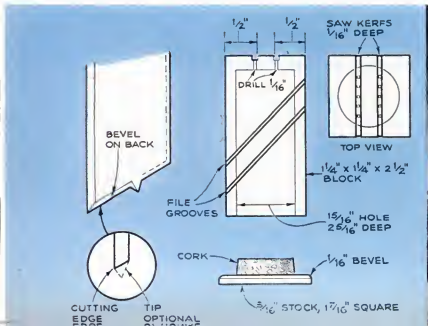
MODERN SHAKER

Like fine crystal, this goes well with any modern table service. You'll need a 1½"-square block of plastic 2½" long for the body, and a bit of 3/16" sheet for the base.

Polish all surfaces of the block by sanding and buffing. Mark the center on one end by drawing diagonals. Bore a 15/16" hole lengthwise, stopping it 3/16" from the other end. Use a homemade flat drill as shown, or a similar flat wood bit (not an auger bit). Be sure to keep the hole parallel to the sides. Sand the inside to a silvery finish with abrasive paper wrapped around a dowel end.

Cut two kerfs in the top and drill 1/16" holes through to the salt cavity. Make the decorative diagonals with a triangular file.

From a big cork, slice a disk that is a push fit in the hole. Push this lightly into place, apply household cement sparingly on its bottom and stick on the square base, immediately aligning it with the body. Let the cement dry thoroughly.



FINISHED SHAKER and the homemade flat drill used to bore the salt cavity are shown here. File cutting edges on a bit of flat steel as in the drawing. Rivet it into a slot in a piece of ½" rod. Blade need not be hardened.

How to Repair Electric Clocks

Are you a clock watcher with a stopped clock? It's easy to start it cooking with amps again.

By L. B. Hedge

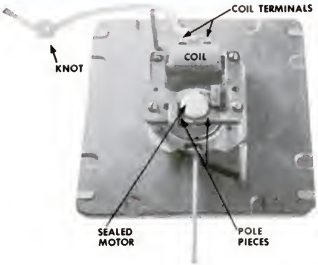
CATCHING an electric clock in a lie comes as a bit of a shock. But it may have warned you. Metallic whisperings, growling and grinding are all signals that a clock isn't happy and plans to quit one of these days.

If one of yours has, you can put it back in the running. If you have a clock that works complainingly, you can restore its good humor. All you need is a few hand tools (chiefly small pliers and screwdrivers), a kitchen table to work on, and enough time to have some fun.

These juice-powered timepieces all have a small synchronous motor, which keeps step with the power-line frequency, and a gear train that drives hands or dials. Their troubles can be boiled down to three:

1. Dirty, gummed gear trains.
2. Defective wiring or coil.
3. Bent or sprung frame, shafts or gears.

How to check for electrical troubles



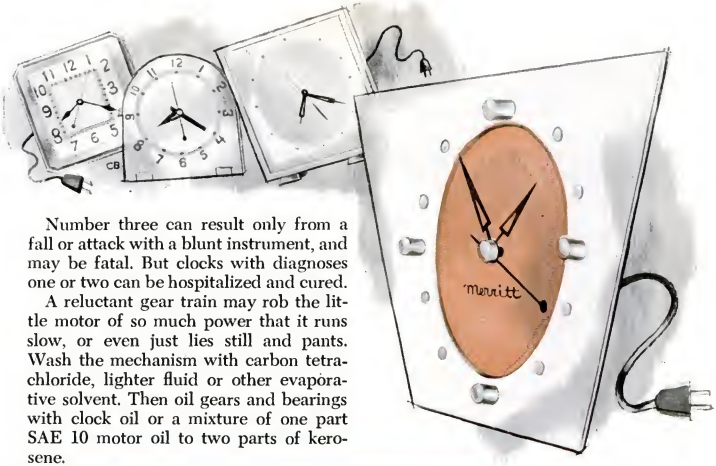
ALL clock motors have a coil of very fine insulated wire, the two ends of which are connected to the cord. You can tell whether the coil is working (even though the clock isn't) by the feel of the starter knob on some models. It spins freely if the coil is dead, drags its feet if the magnet is energized.

Self-starting units like the one above can be checked by holding a paper clip or other bit of steel on a pole piece with the current on (careful not to touch bare terminals!). If current is going through the coil, the metal will buzz vigorously, especially near the pole tips.

This test okays the coil, but a loose connection may make the clock run intermittently, or stop and start when its position is changed. Check connections at the plug first; then inspect connections inside the case; and finally feel along the cord for internal breaks.

These are hard to find, so replace a doubtful cord. Solder it to the coil lugs if the original leads were soldered. Pigtail splices can be soldered, made with small solderless connectors, or as a last resort tightly twisted. Be sure to tape splices. Don't forget the cord knot inside the case that keeps strain off the connections.

If with a new cord and tight connections the magnet produces no buzz, the coil is defective. Open coils like the one shown are easily replaced after taking out the two bolts that hold the center leg of the core to the pole pieces. New coils can be bought from the clock manufacturer. Identify the clock as fully as possible when ordering.



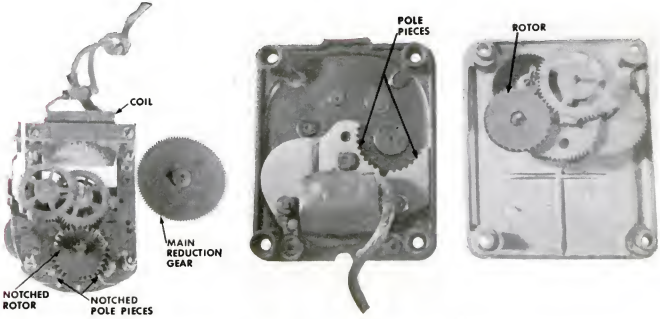
Number three can result only from a fall or attack with a blunt instrument, and may be fatal. But clocks with diagnoses one or two can be hospitalized and cured.

A reluctant gear train may rob the little motor of so much power that it runs slow, or even just lies still and pants. Wash the mechanism with carbon tetrachloride, lighter fluid or other evaporative solvent. Then oil gears and bearings with clock oil or a mixture of one part SAE 10 motor oil to two parts of kerosene.

Clocks with starting buttons are simple

THE phonic-wheel motor has a toothed rotor turning between notched pole pieces. It must be started by hand, but it then keeps step with the alternating current, turning the space of one tooth at each current pulse.

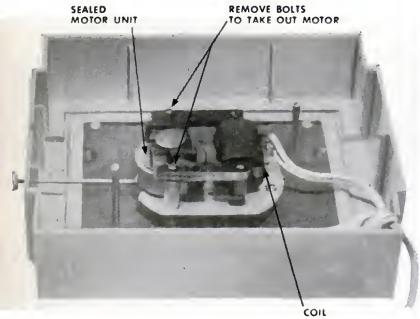
If the coil and its connections are intact, and the gear train clean and undamaged, the clock should be in running order. But any slight resistance, such as may be caused by grit, will stop the motor, which cannot restart itself. Cleaning of the gear train and an electrical checkup are all such a clock should need.



PHONIC-WHEEL MOTORS are shown above. At the left is the Westclox mechanism, with the main reduction gear removed. The center and right photos show the two plates of the Hammond mechanism separated and laid side by side, the coil and field magnet being at the left.

Please turn the page for more tips on electric clocks

Servicing a two-pole sealed-motor unit



WHAT'S INSIDE the motor unit? (Don't open your own.) The two rings at right are driven by the split-phase magnetic field between the pole pieces. Power goes through the gear train to the small pinion at left of case.

ALL the moving parts of the two-pole Telechron motor (also used in General Electric clocks) are enclosed in a sealed drumlike case, from which projects a small drive pinion. Noisy operation often forecasts failure of this unit.

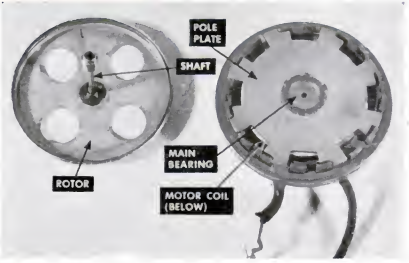
Remove the two long screws indicated in the photo above. (Do not loosen the screws at the coil end.) Note how the spring fingers on the spacer sleeves bear on the motor unit, so that you can replace them the same way. With the screws out, you can lift the motor assembly free and twist the sealed unit out from between the pole pieces.

Gumming up of the gear train inside the case results from leakage or evaporation of the original lubricant, and its

What to do about a multiple shaded-pole unit

USED in Sessions clocks and in various makes of timing devices, this unit has a drum-shaped motor welded to an elongated gear case. The gear train may be gummed up. Pry off the cover (or unsolder it if necessary) to wash out and oil the mechanism. Also see whether the main motor shaft spins freely—torque is small here and failure of lubrication may stall the works.

Should the shaft drag, pry the cover off the motor side and drive out the shaft as shown on the next page. Clean it by twisting it inside a folded strip of fine abrasive paper. Wipe it clean, run light oil into the motor bearing to soak the wick inside, and replace the shaft.



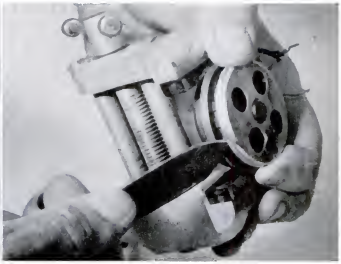
POWER UNIT of this timing motor has a ring-shaped coil under the notched pole plate (above right). The moving member, or rotor, is a thin stamping with either four holes, like the one above, or narrow slots all around it.

PRICK-PUNCH A SPOT on the rim of the case, directly opposite the drive pinion (nowhere else!). Tap-drill for a small screw. Don't poke the drill in far. Turn the tap in only enough to form threads (center photo). Squirt in penetrating oil or cleaning solvent, shake hard, shake the fluid out, and repeat. Then put in a few drops of penetrating oil or oil-kerosene mixture. Close the hole with a screw and a small leather washer. If you have no tap, make a smaller hole. Plug it with a piece cut from the thick part of a wooden toothpick.

contamination with particles worn off the moving parts. You can buy a new unit, but it is usually possible to salvage the old one. Follow the step-by-step picture captions.

Adding too much oil to the gear case after flushing it out may make the clock run slow. Shake out the excess, or blow it out with a medicine dropper. Cleaning and oiling the unit every 12 to 18 months should keep this type of mechanism running indefinitely.

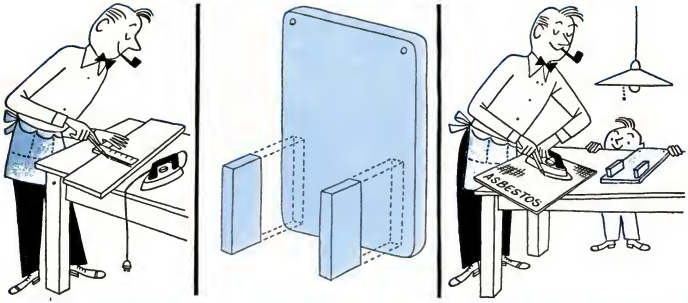
TO REMOVE MOTOR SHAFT, rest the case on blocks or vise jaws as shown here. Place a small nail or thin punch on the end of the shaft in the rotor and drive it out. Take care not to dent or bend the rotor itself.

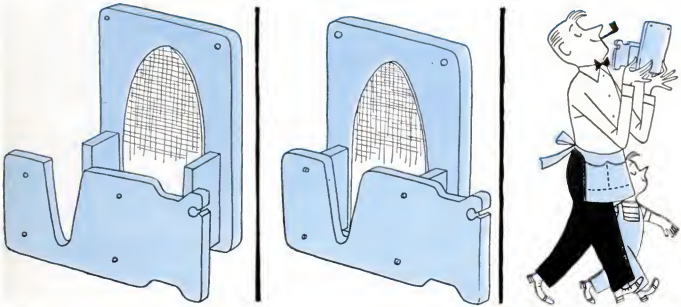


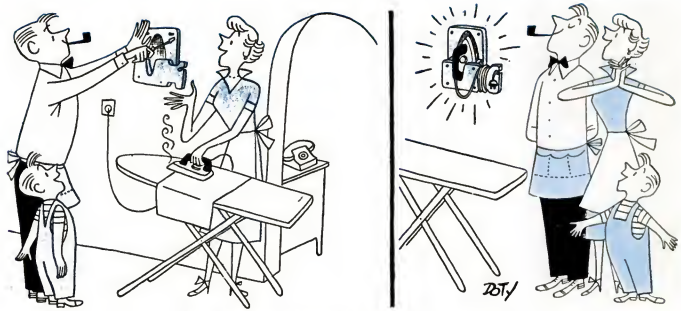
A BENT ROTOR may drag against the pole plate just enough to keep the unit from running. This is easy to spot, and a little judicious bending with a knife point, like this, will put the rotor back in working shape. END

By Roy Doty and Norm Jacky

Wordless Workshop

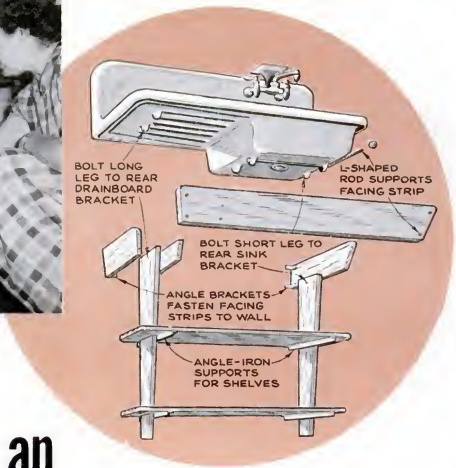






Next Month: A toy car that rolls or rocks

PLENTY OF SAFE SPACE for electrical appliances here, in addition to the usual assortment of canisters. Even the African violets thrive.



How to Give an Old Sink a Lift

Five dollars' worth of redwood ends dishpan stoop and gives you two handy storage shelves.

TROUBLED by an old kitchen sink that's a back-breaking 30 inches from the floor? You can give it a face lifting, and add two storage shelves and the modern look—all with five dollars' worth of 1″ redwood, a few pipe fittings and odds and ends from your scrap box.

Shape the legs first. They should be long enough to put the drainboard 36″ above floor level. One leg will be bolted to the original leg bracket under the drainboard and the other to a bracket on the sink bottom.

Next, cut the shelves, making them a few inches longer than the leg spacing. Measure the leg cross sections at the two shelf heights and cut rectangular holes in the shelves to correspond. Slip the shelves in position and anchor them with some short sections of angle iron.

Tailor the facing strips to fit flush with the drainboard and sink edges. Note that sloping end-cuts give the boards an inward tilt toward the bottom.

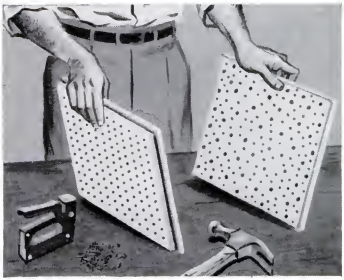
Now, uncouple the drain and faucet fittings, take out the bolts that attached the sink to the original metal legs, and lift the sink clear of its wall hangers. Raise the hangers to the desired height, and with nipples and elbows extend the hot- and cold-water pipes up and outward to realign with the holes in the sink back. Insert a drainpipe extension either above or below the trap.

Bolt the leg-and-shelf assembly to the undersink brackets and slip the sink back on its wall hangers. Recouple the faucet and drain connections.

The sink-facing assembly is attached to the wall with L-shaped brackets and held up at the front by a redwood arm projecting from the leg under the drainboard. For further support, a piece of light drill rod is passed through the unused leg bracket under the sink and bent forward to a countersunk bolt connection with the front strip.

How to sound condition your basement workroom

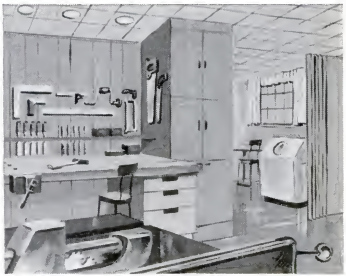
Much of the enjoyment and relaxation of working in your basement can be spoiled by disturbing noise. Cut down the annoying effects of power tools, hammering, and sawing by sound conditioning your basement with a ceiling of Armstrong's Cushiontone® or Perforated Temlok Tile. Besides absorbing noise, these tiles provide an attractive ceiling finish you can install yourself.



1. Economical wood fiber materials. Both Cushiontone and Temlok Tile are low in cost, attractive in appearance. They are factory-finished, can be washed or repainted if desired. Cushiontone's noise-trapping holes are arranged in an attractive "Full Random" pattern, while Temlok's perforations are in neat straight rows.

2. Installation is easy. Start by nailing up 1" x 3" seasoned wood furring strips at right angles to the joists on 12" centers. Furring should be shimmed where necessary to provide a level surface for nailing or stapling. If existing ceiling is plaster, gypsum board, or any other smooth, firm surface, Cushiontone can be cemented directly to it.

3. A professional-looking job is assured by the special Lok-Bevel joint on Temlok Tile. Use four 1¼" 3d box nails or four staples with ½" legs for each tile. With Cushiontone, use flathead or collar nails in shallow-drilled corner holes. Nailheads should be ⅛" or 5/32" wide; nails at least ½" longer than thickness of Cushiontone.



4. Job's done in a few hours. You'll have a good-looking, practical ceiling that will solve your basement noise problem permanently. In fact, your family will probably be so pleased with the new-found quiet, they'll want you to sound condition the kitchen, den, and TV room with Armstrong's Cushiontone or Perforated Temlok Tile.

Your building materials dealer will be glad to give you full details on Full Random Cushiontone, Perforated Temlok Tile, and Armstrong's other building materials. For a free booklet on Cushiontone and Temlok acoustical ceilings, write Armstrong Cork Company, 3911 Washington Avenue, Lancaster, Pennsylvania.

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Now it's so easy to print your own snapshots! You can do it with the room lights on!

Watch a picture you've taken appear as if by magic on a blank sheet of paper in the developing tray. We wager you'll get the thrill of a lifetime!

It's all so easy with the Kodak Velite Paper that's included in Kodacraft Outfits. You can print a picture in daylight or under any type of electric light ordinarily used in your home.

The pictures below show how really simple it all is. *As little as $5.25 can start you off.* Your best friend to see is your Kodak dealer.

Kodacraft Photo Developing and Printing Outfits are designed for ease of use, contain all basic equipment. Kodacraft Printing Kit, $5.25; Kodacraft Photo-Lab Outfit (illustrated), $9.75; Kodacraft Advanced Photo-Lab, $14.95.

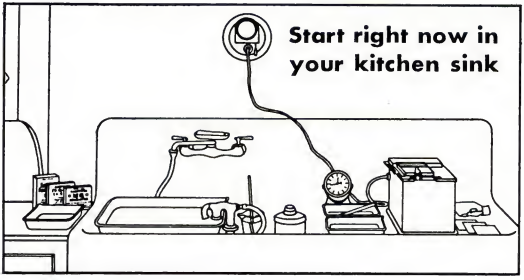
Expose 20 secs. Place negative and Velite Paper in printing frame and expose with 100-watt bulb in reflector of gooseneck desk lamp at 8 inches.

Develop 60 secs. Remove Velite Paper and place in developer. Rock tray gently. Picture will appear in about 60 seconds. You'll scarcely believe your eyes.

Use stop bath 15 secs. Next drop into stop bath and agitate 15 secs. (Isn't this an easy way to make extra prints for friends—or personal photogreeting cards.)

Place in fixer. Take print from stop bath and place in fixing bath. Soak for 5-10 minutes. Wash in running water—then dry in blotter.

No elaborate equipment needed to become expert at this hobby



Once you've enjoyed the thrill of printing your own photos and gained some experience, you'll want to develop your own film—and eventually make big, dramatic *enlargements*.

The modestly priced Kodacraft Photo-Lab Outfits have everything you need to start off. Later on, as you advance, you'll want to add such pieces of Kodak equipment as are shown below. Equipment arrangement should allow a smooth flow of work from printing frame through developer, stop bath, fixing, and washing with everything compactly grouped so operations can be performed with a minimum of steps. If there's no lamp socket over the sink, safelight can be placed on extension cord.

Your Kodak dealer can give you valuable help on this project. Among the literature available is the booklet, "Developing, Printing and Enlarging," which you'll find extremely useful. Why not see him before the weekend?

Time-saving print dryer. Kodak Photo Blotter Roll prevents prints from curling. $2.88

Handy combination funnel. Kodak Combination Funnel provides 3 sizes of funnels. $.85

Low-cost timer. Kodak Timer (with split-second hands) can be restarted without resetting. $7.95

Automatic print-washing. Kodak Automatic Tray Siphon attaches to water faucet. $4.50

2-way safelamp. For enlarging, black-out kitchen window—use Kodak 2-way Safelamp. $4.50

Popular-priced enlarger complete with lens. Kodak Hobbyist takes negatives up to 2¼ x 3¼ inches. "Cold-light" protects negatives. New-type, easy loading. $57.50

Prices are subject to change without notice

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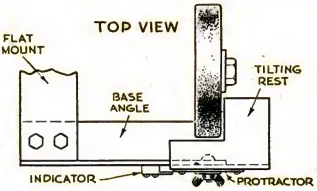
Rochester 4, N. Y.

NEW Shop Ideas

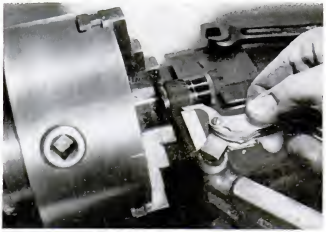


Graduated Grinding Rest. A dime-store protractor enables me to grind tool bits to specified angles, and to regrind them with a minimum of waste by resetting the rest to the same angle.

One piece of angle iron is mounted on my grinder parallel to the wheel shaft on a piece of flat stock. Another, notched around the wheel, pivots on a bolt near the upper corner of the stationary angle. The protractor is attached to this piece and an indicator to the other. Angle grinding is done on the side of the wheel. In the full-down position, the rest is automatically at 90° to the wheel side.—*Warren W. Lacey, Queens Village, N. Y.*

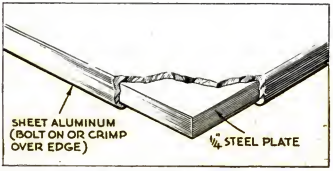
Centerdrill Without a Lathe. Shafts can be centerdrilled accurately in a drill press. For shafts from ¼″ to ¾″, you need a set of 5 machine bushings from ⅛″ to ¾″ inside diameter and 1″ long, with 1/16″ walls, so that they will telescope.

The photo shows a ½″ shaft being centerdrilled ¼″. The ½″ bushing is slipped on the shaft, the ⅜″ bushing goes into it, and the ¼″ bushing, in the ⅜″, guides the drill. If the hole is to be smaller than the bushing bore, start it with a drill that fits, and then change to the desired size.



Gauge Chases Threads. Fine threads cut in the lathe may seem tight because of microscopic chips. A hardened-steel threading gauge can be used to clean and deburr such threads in brass or other soft metal. Mount a square-ended bit in the tool post as a rest, and with the work turning slowly, apply the gauge as above.—*John J. McGuckin, Ridgewood, N. J.*

Nontack Welding Surface. Copper makes a fine top for welding tables because the arc will not tack work to it, but it is expensive in big sheets. Many sheet-metal shops will sell cheaply scraps of sheet aluminum, which serves the same purpose. It burns through easily but, by moving work around, almost the entire area can be used before the sheet has to be replaced.



Please turn to page 238 for more shop tips

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Your car will start fast with patented

FIVE-RIB CHAMPION SPARK PLUGS!

Whatever the weather . . . just touch the starter and your full-firing Champion Spark Plugs go to work!

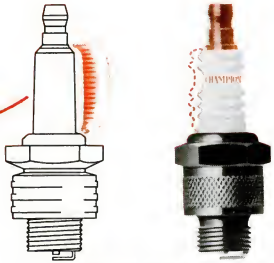
Champion's exclusive FIVE-RIB insulator design protects you against electrical "flash-over" due to dampness—a major cause of hard starting.

Compare a FIVE-RIB Champion with an ordinary spark plug and you'll see why.

Champion's insulating surface is greater because of its ribbed construction. Exterior electricity is diverted and spent before it can short out a damp plug. Tests prove this gives you as much as forty percent more protection than smooth insulator types under the same conditions.

Get the jump on winter now. Let your Champion dealer install a set of FIVE-RIB Champions when your car has its winter change-over.

You'll get going, and get where you're going, with Champions!



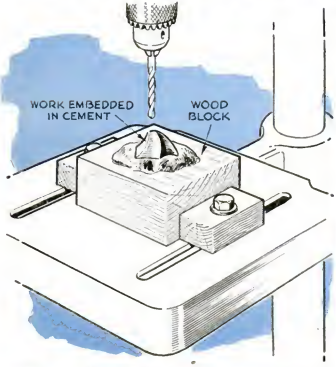
INSIST ON FIVE-RIB

CHAMPIONS

CHAMPION SPARK PLUG COMPANY, TOLEDO 1, OHIO

Fishline Stops Lathe. With a big repeat run on hand, some means of stopping a lathe at a predetermined spot was needed in a hurry. A length of fishline was tied to the half-nut lever as shown at left, looped back through a screw eye, and run along the lathe bench to another screw eye and the motor switch. The operator chucked each piece and started the lathe. As the carriage neared the end of the cut, the line flipped the switch off.

For reliable tripping each time, be sure to use nonstretching line or prestretch it before rigging such a stop.—*Floyd McGuckin, Ridgewood, N. J.*



Cement as Drilling Fixture. Oddly shaped work can be hard to hold even in a drill-press vise. With a lot of identical pieces of this kind to drill, I gouged an oversize hole in a block of wood and filled it with common iron cement. One of the workpieces was lightly oiled and pressed into the soft cement in the desired drilling position.

When the cement was hard, the oiled piece was removed, leaving a cavity that held each piece in precise alignment for drilling.—*R. H. Richter, Detroit.*

▶▶▶Cutting oil can be had for the taking in any kitchen. Bacon grease, poured into a can to harden, can be applied with a small brush just as it comes from the container. Heat generated by turning or threading promptly melts it on the work.

Brush as Soldering Aid. One of those brass-wire brushes sold for treating suede shoes makes quick work of cleaning metal prior to soldering. It's also handy for wiping the tip of the iron.—*Gilbert C. Close, Hawthorne, Calif.*

Do-It-Yourself . . . Do More . . . Do Better

with STANLEY TOOLS

Take this folding rule. Only the inches are like other rules. Even these last longer. The sticks are extra thick and plastic coating protects the markings against wear. 8 in. brass slide extends 6 inches either end, or may be removed to measure where rule won't fit. Rule opens to even numbers . . . folds to convenient marking gauge for even inches from 2 to 12. Ask for Stanley "100 PLUS" No. X226. $2.75.

Try this nail hammer. Stanley solves the problem of hitting 'em where you ain't . . . at least where you can't reach to hold and hit — over your head. The claw grips the nail, the slot seats the head . . . you reach over your head and start the nail. Then finish the job with the business end of the hammer. Ask for Stanley NAILMASTER No. 51½ . $3.35.

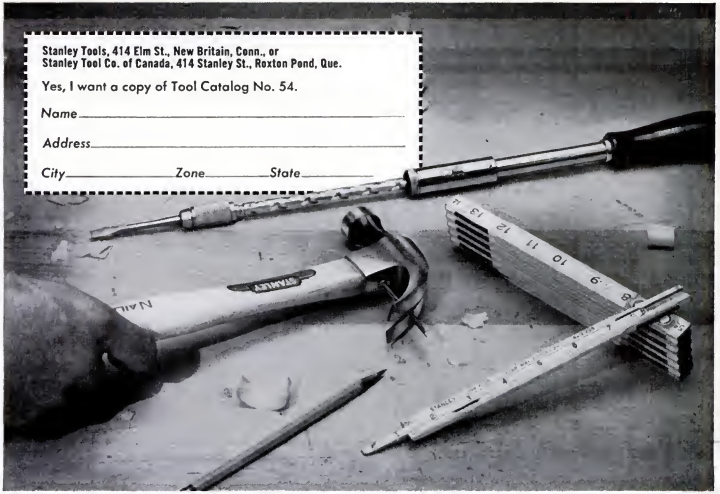
Inspect this screw driver. Here's a tool that deserves inspection . . . that'll stand it. This is a professional tool, used for years by craftsmen in industry, in the home shop. It does more than drive screws. With this "Yankee" you drive and draw one hand, thanks to ratchet action and quick-return handle. It's fast and easy. Ask for "Yankee" Spiral Ratchet Screw Driver No. 130A. $7.70 (Includes three different size bits).

Look for Stanley and "Yankee" when you look for fine tools. Use coupon for free catalog.

THE TOOLBOX OF THE WORLD

STANLEY® Tools

A Division of The Stanley Works



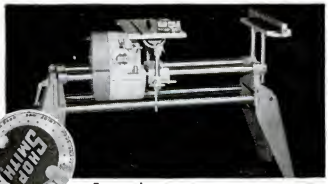
TOOLS • ELECTRIC TOOLS • HARDWARE • STEEL • STEEL STRAPPING

SPEED-DIAL on NEW SHOPSMITH* Mark 5 PINPOINTS THE RIGHT SPEED FOR EVERY JOB!

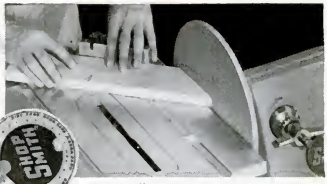
Find the right speed for any job and you're on the way to safer, more accurate work. Now SHOPSMITH with Speed-Dial makes it easy to find the exact speed . . . makes accurate work possible for everyone.

Just set exclusive Speed-Dial for the job you want—Saw, Jointer, Jigsaw, Dadoing, Sanding, etc. No bothersome belts and pulleys to change. No more "next best" speeds to spoil your craftsmanship. An infinitely variable selection of speeds from 700 to 5200 rpm.

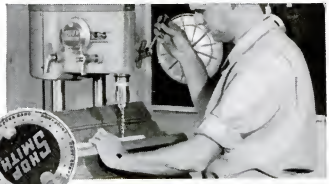
*T.M. Reg. U. S. and Foreign Countries



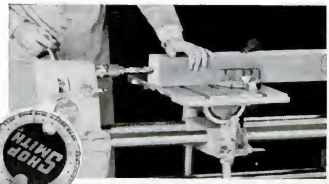
For sawing – Cross-cutting, ripping, dadoing, molding . . . each has a separate Speed-Dial setting. Powerful 9" circular saw cuts 2" lumber even at 45° angle. Adjustable extension table supports work up to 48" from blade. Quick-change saw arbors for easy blade switches.



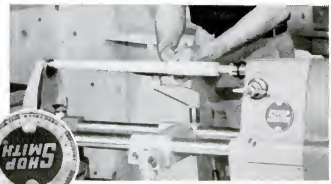
For sanding – Individual Speed-Dial settings for coarse, medium and fine sanding of plastics, metal or wood. Big 12" disc has 113 sq. in. of sanding surface. Disc feeds into work. Depth control dial and built-in jigs assure precise duplication of work *without repeated measurements.*



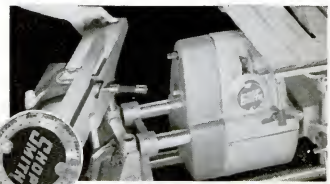
For drilling – Different Speed-Dial settings to cover a complete range of drilling wood, metal, plastics. Vertical Drill Press drills to center of 16½" circle, handles floor drill press operations with up to 58" between chuck and floor . . . has depth control dial and ready-made jigs.



For horizontal boring – Low-speed settings for large-diameter boring. Other Speed-Dial settings for doweling, routing, shaping. Unlimited capacity for drilling in a horizontal plane. Rigid fence support with adjustable table height makes drilling for doweling easy and accurate.



For wood turning – Individual Speed-Dial settings for turning a full range of diameters. SHOPSMITH is unexcelled as lathe, with 16½" swing and 34" between centers. Tool rest slides parallel to work without constant readjustment. Exclusive eccentric cup center mount for turning tapers.



Another SHOPSMITH Mark 5 exclusive – New POWER MOUNT! Add jointer, jigsaw, bandsaw, etc., with twist of a handle, one turn of a setscrew. Complete range of Speed-Dial settings available for every POWER MOUNT operation.

Want a SHOPSMITH for Christmas? Let us help. Clip and mail coupon right now. We'll write to your favorite Santa and tell her what wonderful things you could do for the whole family if you were to receive a SHOPSMITH Mark 5 for Christmas.

See the new SHOPSMITH Mark 5 at your hardware or local Montgomery Ward store. It's the modern power tool that comes ready to plug in and go to work. No extras to buy. Complete with powerful built-in ¾-hp. motor and bench. Only **$269.50!**

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Please put the SHOPSMITH bug in the ear of

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Name and Address

Please rush me FREE 20-page SHOPSMITH catalog.

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Easy Rewinding Job Salvages Burned-Out Earphones

Don't throw them away; magnet wire can make them as good as new, and more useful than ever.

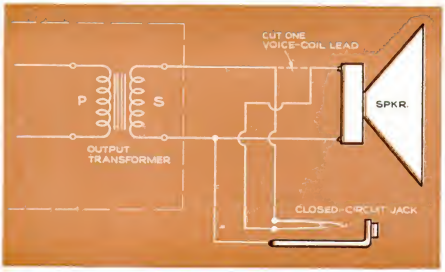
ONE look at the hair-fine wire on earphone bobbins may convince you that rewinding them would be a hair-raising job. But it's actually easy to do if you use ordinary magnet wire. The result is a pair of low-impedance phones that match radio and TV output transformers, have good tone quality, and can be driven hard before they distort.

You can use such phones for testing, letting children listen when you want quiet, watching late TV shows after most of the family is asleep, or as under-the-pillow speakers for bedside radios.

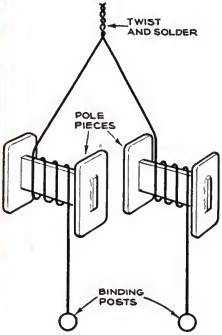
Take the phones apart and remove the fine windings by cutting across them with a single-edge razor blade. Wind two layers of No. 28 cotton-enamel wire on each pole piece in the same direction and with the same number of turns. Connect the starts of both windings and bring the other ends to the binding posts as in the drawing below. This will make current flow in opposite directions through the two bobbins.

Connect the cord so that the two phones of a headset are in phase. To check this, touch the tips to a 1½-volt flashlight cell and see whether both diaphragms move in the same direction. If not, reverse connections to one phone.—*Arthur Trauffer, Council Bluffs, Iowa.*

WITH BOBBINS REWOUND for low impedance (foreground), this earphone is ready for reassembly and years of service. Horseshoe magnets must be replaced with like poles touching. If in doubt, hang one by a thread and bring other near it. Poles that repel go together.



HOOKUP FOR LISTENING to a radio or TV set with converted earphones. Wire a closed-circuit phone jack into leads to the voice coil of speaker as above. Speaker is silenced when the phones are plugged in. On AC-DC radios, mount the jack on the cabinet or otherwise insulate it from the hot chassis.



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that has everything any homecraftsman or hobbyist needs

FOR SCORES OF MONEY-SAVING JOBS

Perfect gift to give or receive . . . useful all year 'round. Each kit includes:

- **Weller 8250A Soldering Gun—250 watts**
- **Famous Kester Solder—general purpose spool**
- **Soldering Tip—for all kinds of soldering**
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- **Wrench—for tip interchange**
- **Instruction Booklets—handy soldering and homecraft hints**
- **Metal Case—for storage and carrying**

Nothing else to buy for soldering, sealing, cutting, mending, joining and smoothing. Makes professional results easy.

only $14.95

MODEL 8250AK

NEW WELLER GUNS AND KITS ARE AVAILABLE AT HARDWARE DEALERS

Junior

SOLDERING GUN

- **New, Compact Design**
- **Heats in 5 Seconds**
- **Over 100 Watts**
- **Trigger Switch Control**
- **Dual Spotlights**

The ideal homecrafters' soldering tool. No other soldering gun or iron offers the professional quality, practical features and low price of the Weller JUNIOR.

Weller THE FINEST TOOLS FOR THE FINEST CRAFTSMEN

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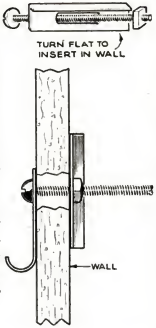
806 Packer St., Easton, Pa.

SOLDERING GUNS • SOLDERING KITS • POWER SANDERS

Emery Cleans Typing Eraser

A TYPING eraser won't smudge the paper if you clean it first on an emery board kept conveniently taped to the typewriter. Brush the eraser dirt off to the side so it can't fall into the machine.

Toggle Can Be Made Quickly



TO MAKE a toggle bolt quickly, cut a lengthwise slot on a short piece of light angle iron, just wide enough for a bolt. Turn a nut ⅜" on the bolt. Lay it against the inside of the angle iron. Insert the toggle in the wall and pull the bolt out toward you, then screw the bolt together. The angle iron will prevent the nut from turning. *—C. H. Hardy, Los Angeles.*

Rubber Holds Small Glue Jobs

NEXT time you have a gluing job that is too small or irregular to handle conveniently in a clamp, get a long piece of model-plane motor rubber and wind it around the assembly.

Start in the middle and work back and forth toward the ends, stretching the rubber as you wind. Tuck in the ends. Most glues and cements will not adhere appreciably to the rubber.*—Roy L. Clough Jr., Bristol, N.H.*

How I Made My Ladder Safer

By Andrew Vena

WHOOPS! JUST AIR as I drop my foot while descending the top section of my extension ladder which I frequently use by itself. I keep forgetting the maker omitted a rung at this point because of the locks. So . . .

IN GOES A RUNG, a piece of ¾" pipe welded to two 3/16"-by-1¼"-by-12" steel bars in an H-shaped assembly. The lower ends of this are fastened by the lock-mounting bolts while the top ends are held by two extra carriage bolts. Washers space out bars so locks can work.

NOW, THAT'S MUCH BETTER! The new rung, rigid and safe, eliminates the possibility of a long, jarring drop to the ground.

THE GREATEST INVENTION SINCE THE HAND SAW . . .

New AMF DeWalt "Power Shop" brings out the expert in you!

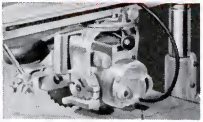
Today, AMF De Walt® "Power Shop" is everywhere known and accepted as the one really safe, accurate, easy-to-use machine. It's so designed that even the inexperienced can *expertly* do everything in home woodworking.

Whether you're modernizing, decorating or repairing your home, AMF De Walt is your best investment. See it demonstrated today. At your De Walt Dealer's or fine hardware and department stores.

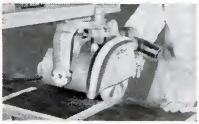
$229 delivered (saw blade and custom-built ½ H. P. motor included). EASY TERMS.

All these exclusive extra-value advantages!

TOP-SIDE CUTTING! No guesswork—no mistakes. You always see the cut because layout marks are visible and easy to follow.



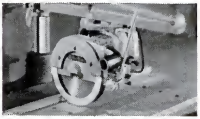
PROFESSIONAL ACCURACY! Calibrated scales for miter, bevel and rip are visible above table. Instantaneous settings!



EASY TO USE! You control ball-bearing travel head in radial arm. Moves smoothly, precisely. All cuts perfect—no spoilage.

COMPLETE VERSATILITY! One powerful direct-drive motor accommodates any circular tool—gives full home workshop flexibility.

NO FLOOR SPACE NEEDED! Builds into your workbench! When not in use radial arm swings conveniently out of way, freeing work area.



HOME SAFETY FEATURES! "Stop" red controls, UL*-approved motor, safety key switch, auto-float safety guard (optional).

*Underwriters' Laboratories, Inc.

PLUS BIG CAPACITY and many more extra-value features—all explained in new FREE 20-PAGE COLOR BOOKLET!

Another AMF Product

DE WALT POWER TOOLS

De Walt Inc. • Lancaster, Penna., U.S.A.
IN CANADA: De Walt Canada Ltd., Guelph, Ontario

Send this coupon today!

☐ Please send me free illustrated booklet "The Greatest Invention Since The Hand Saw" showing how your Power Shop makes me a woodworking expert, saves money in my home.

☐ Please send me free blueprint "Building A Home Workbench."

Name.....

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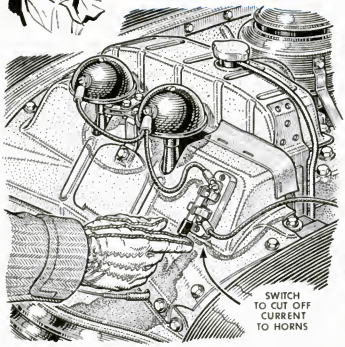
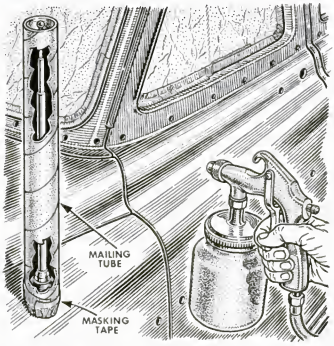
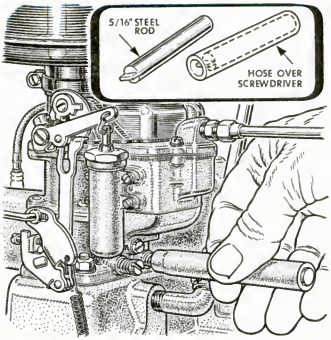
Hints FROM THE MODEL GARAGE



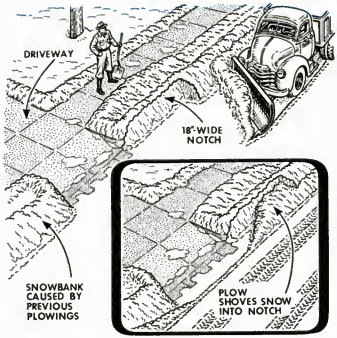
Install a knife switch in the power lead and you'll never be embarrassed if a stuck relay or grounded wire makes your horn break into a noisy solo. Just pull the switch to break the circuit quickly.



A mailing tube can save you the trouble of masking your car's radio antenna next time you want to do a partial or complete body refinishing job. Just slip the tube over the end of the telescoped antenna.



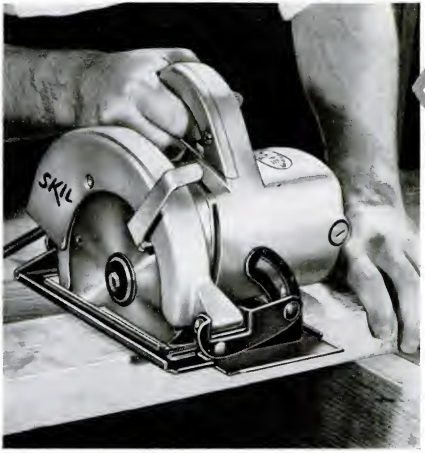
This screwdriver stays aligned with carburetor adjusting screws while you give your full attention to tune-up jobs. Make the screwdriver from 5/16″ rod and draw on a tight sleeve of rubber hose with a ¾″ extension to fit over the screwhead.



A snowplow won't backfill your driveway if you dig a notch about 18″ wide and 8′ long in the snowbank in the direction from which the plow will come. This gives the plow blade a chance to dump its load before it reaches the shoveled-out drive.

 Please turn to page 248 for more auto hints

Compare the New SKIL Saw Value with any other...



at only

$49.50

MODEL 526

Only $39.95 more . . . Converts SKIL Saw to all-around combination tool

It's another SKIL "scoop"! This sturdy SKIL table makes your portable SKIL Saw an accurate, tilting arbor bench saw. Combination meets all sawing needs . . . Portable saw for building or remodeling jobs—plus a bench saw for precision furniture or cabinet work. SKIL Saw Table Combination, only $89.45.

SKIL Home Shop ¼" Drill
$24.95 with hex-key chuck
$26.95 with geared chuck

SKIL Home Shop Belt Sander 2¼"...$79.50

SKIL Home Shop 6" Sander-Polisher...$43.95

Here's why it's your best buy

For building, remodeling, repairing, or just making things, the new SKIL Saw is designed for you! Only SKIL "know how" could produce this value leader. From blade to handle it's everything that has made SKIL the outstanding name in portable saws.

That's why we say, "Compare the new SKIL Saw Value—with any other, at any price—before you spend a cent!" Compare the features, the balance, the workmanship, sturdiness, power and versatility! Then remember—that the name "SKIL" on any power tool means it's the best money can buy. Only SKIL—the leader—can dare to ask you to compare!

Compare these Features! No other saw at this price can match them!

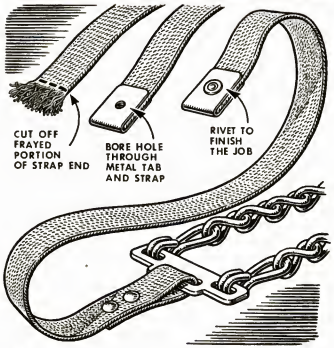
Oversize Motor . . . Ball and Anti-Friction Bearings . . . Built-In-Bevel and Depth Adjustment . . . Telescopic Safety Guard . . . Trigger-Type Switch . . . Sturdy, Die Cast Aluminum Housing . . . and many other SKIL-made "firsts."

SKIL
HOME SHOP TOOLS

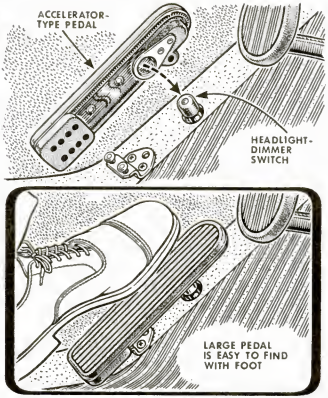
SKIL Home Shop and Builder's Saws available in 6", 7¼", 8¼" blade sizes. There are more than 22 SKIL Home Shop Tools to speed work, save time and money for home-owners.

Made only by SKIL Corporation, formerly SKILSAW, Inc., 5033 Elston Ave., Chicago 30, Ill. • In Canada: SKILTOOLS, Ltd., Toronto 9 • Factory branches in All Leading Cities

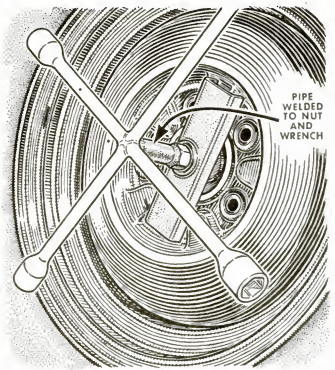
MORE Hints from the Model Garage



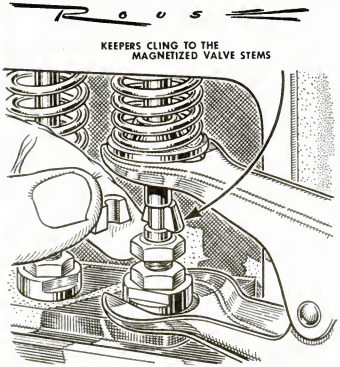
Metal tabs made from linoleum rug binding and riveted over the strap ends of emergency tire chains will eliminate fabric fraying and speed up the job of threading the straps through finger-freezing wheel slots and chain buckles.



No floundering to find the headlight-beam switch, when you hinge a replacement accelerator pedal over it. Rivet a plate with a hole in it to the bottom of the pedal, slip the hole over the switch button and mount the pedal on the hinge plate.



A lug wrench is always handy and the spare-tire retaining nut won't get lost if you braze the nut to a short piece of pipe and weld the pipe at right angles to the center of the wrench. Make sure the pipe will admit the retaining-rod end.



Magnetism can be used to hold the keepers in place during reassembly after a valve job. Stroke the ends of the valve stems with a powerful alnico magnet before dropping the valves back into the block. The small keepers will then leap to the stem.

Rockwell-built DELTA 24" Scroll Saw

Delta 24" Scroll Saw—standard of quality for industry, and for the finest home shops. (Also available in Homecraft 16" model).

ONLY THE FINEST IS GOOD ENOUGH

The Delta 24" Scroll Saw is—beyond all doubt—the finest scroll (or jig) saw made—at any price. Proven through years of punishing mass production operation, it is the accepted standard in the woodworking and pattern making industries.

What better recommendation for *your* home workshop—where superior, more professional projects demand real quality and soundness in the tools you use?

Only on a Delta Scroll Saw can you expect Delta Quality "extras." This versatile machine cuts stock up to 2" thick, yet also cuts the most delicate veneer. Since it is available in both 4-speed and variable-speed models, you can cut metal and plastics as well as wood. Removal of the overarm converts it to a saber saw of unlimited capacity.

And the unique Delta design makes it possible for you to cut from front, side, or from any angle of approach.

See for yourself the simplicity—the genuine ease of operation—the basic quality built into this Delta 24" Scroll Saw. At home and in the finest cabinet shops there is no better scroll saw. Let your Delta Dealer Demonstrate it for you (he's listed in your classified directory under "Tools" or "Machinery"), or send the coupon today.

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DELTA ROCKWELL

DELTA QUALITY POWER TOOLS

Another Product by **Rockwell**

[Continued from page 172]

sandths oversize, would surely come here, where the metal was thinnest. At least there would be cylinder-wall distortion. Or maybe, he thought, there had been no freeze-up on this car. Where would that possibility leave him?

Gus looked grim, and then a slow smile formed at his mouth. How many times over the years had he leaned against this bench thinking that he was at the end of his rope? Yet always, somehow, things had worked out. They would this time, too, he decided.

He had water and he had oil, he told himself, in passages. At what places that he hadn't thought of could these two possibly meet? Gus visualized the construction of the engine block. Nothing but a crack, he decided, could put water in the timing-gear case; but the chances of its being there were so slim that the water must be running down there from the valve compartment. Gus moved forward, intent on pulling valve, springs and guides, for a closer inspection, when Barney Overholtz came into the garage.

"Hi, Mr. Wilson," he said, and then his eyes fell on his car. "Gosh!" he exclaimed. "You're working on it yourself."

"Yeah," Gus drawled. "Stevens and Bartlett tell me that your guarantee has expired. They won't do anything."

Gus Puts Bill on the Cuff

Barney's trustful eyes rested on Gus's face. "Golly, Mr. Wilson, I won't be able to pay you for a while, because right now I'm broke. I had to pay Mr. Kleiber, over at Stanfield yesterday, for a new water pump. The left-hand one wobbled."

"Don't worry about it," Gus said. Then, thoughtfully: "You say you put on a new water pump yesterday?"

Gus found his mind chewing on a startling idea. The water pump had been put on just before water appeared in the crankcase. Was there any connection? Gus recalled that there was a small oil hole drilled from the valve compartment through the block, to meet a similar hole in each water pump. Oil flowed down these holes to lubricate the water pumps. But this was grabbing at straws, Gus told himself. No one had ever heard of water traveling along a pump shaft, up these oil holes into the valve compartment. He peered into the valve compartment again, but could see nothing. He began to pull the new, left-hand water pump.

"What are you doing now?" Barney wanted to know.

"Grabbing at straws," Gus told him grimly.

With the pump off, Gus probed down the oil hole. It ran on a slant from a point within a half-inch of the pump rotor to the pump shaft. But this one had been inaccurately drilled. The side of the hole had broken out into the pump water jacket. Pressure from a filled radiator had forced water up the oil hole and into the front end of the valve compartment, where it ran down into the timing-gear case.

Trouble at Long Distance

"Out of a million water pumps," Gus said disgustedly, looking at it, "maybe one was badly drilled like this. And you had to get it, Barney. Goes to show that when a workman does a sloppy job, it can hurt someone a thousand miles away."

"I guess," Barney said thoughtfully, "a fellow should always do things real careful, like you do, Mr. Wilson."

"Me?" Gus chuckled. "Why, I'm not careful. I just bumble around, grabbing at straws. This one was awfully thin."

The phone rang again.

"We've been thinking," Stevens said over the wire, "about that car we sold the newspaper boy. You fix it up, Wilson, and bill us . . ."

"Goes to show, Barney," Gus grinned, "that folks are more honest than we sometimes give them credit for. Stevens won't have to pay, on account of the faulty pump, but that man has a conscience, after all." END

NEXT MONTH: Gus backs into Christmas.

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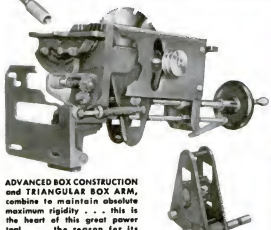

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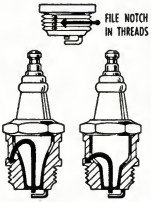
Care and Feeding of Engines

BY S. P. CORP

SPARK PLUG CARE

When tuning up, be sure to sand-blast electrodes and porcelain on all plugs, to remove metallic oxide coating. Then inspect threads to make sure they are sharp and not rounded off. Rounded threads will not form a good seal with threads of the cylinder head, and will cause loss of power. Take an old plug, with good sharp threads, and cut a groove through the threads with a 3-cornered file. Use this plug as a die to cut the carbon from the threads in the cylinder head. Then remove plug and clean cylinder head threads with compressed air before installing new plug. Such carbon causes poor plug performance by restricting heat transfer, and can cause a compression leak.



Individual engines operate under varying conditions. If an engine runs cool, a hotter plug will increase operating efficiency. Such a plug has a longer white insulator and retains heat to burn oil vapor that may get past valve guides, in worn engines. Do not use a hot plug in an engine with good compression. Cool plugs, with very short insulators, should be used only if engine operates under very hot running conditions. Be sure your new plugs have sharp threads to make a good seal in the cylinder head.

DOES YOUR STARTER JAM?

Then get a starter wrench. Remove live wire from battery, hot wire from starter, and use starter wrench to remove starter from engine. Clean screw drive and pinion with kerosene (not gasoline!) and check pinion spring for possible damage. Lubricate drive screw and pinion with engine oil. Make sure armature shaft is not bent; see that drive spring screws are tight. Then remove any burrs from teeth of starter ring gear, as these could cause starter pinion to jam.

VALUABLE MANUAL FREE!

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Sealed Power

PISTON RINGS

'55 Pontiac Is New All Over

[Continued from page 133]

engine speeds. Mostly it's a matter of valve timing.

The Pontiac V-8's torque peak occurs at an r.p.m. that, with a Hydra-Matic transmission, becomes a road speed of about 64 miles an hour. That means zip for passing, with less time on the wrong side of the road. The engine's top horsepower, incidentally, is produced at a higher r.p.m.—4,600—than that of any other U.S. passenger-car engine presently made.

In refurbishing the entire car, the Pontiac Division has gone by the book of current, accepted design. It reflects everything conservative in the attitudes of its parent corporation, GM. (You could almost swear to the impression that Pontiac dallied over its new engine until the grayheads around the shop satisfied themselves that the overhead-valve V-8 was here to stay!)

Pontiac Is Fifth in Sales

The vehicle contains nothing sensational. That's in keeping with its 29-year tradition. It's also in keeping with the thinking of a management that for 15 years has sold more cars off the showroom floor than any other company save the Big Three—Chevrolet, Ford and Plymouth—and Buick. Men with a good thing don't take needless risks. When they design cars these days, they unconsciously think back to the early 1930's when Chrysler almost met disaster with a piece of exotic styling. The Chrysler Airflow made sense to everybody but the public. It was a sober, harrowing experience to Detroit.

Like that on all the other cars lately, the hood on the '55 Pontiac is down. The fenders are up. On the Star Chief the driver can see all four. Control knobs are recessed to discourage any intent to suicide by impalement. Despite a narrowing of the car, seats are wider—the stylists simply got rid of air between the sheet metal and the cloth trim.

The fresh-air intake for the passengers

[Continued on page 254]

Faster, Easier Gluing

with new squeeze bottle

Here's a ready-to-use glue that's strong enough for practically all your light woodwork projects and repair jobs. It's quick setting, dries clear . . . glues wood, paper, cloth and all porous materials. Try Elmer's Glue-All in the new, handy, plastic applicator bottle . . . get the large 8-oz. workshop size at leading hardware stores. Write for folder: The Borden Company, Chemical Division, Dept. PS-114, 350 Madison Avenue, New York 17, N. Y.

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Send check or money order for only $5 to TESTMASTER, Inc. now and pay balance plus C.O.D. charges when you receive the sensational new Model 208 by return mail.

MONEY-BACK GUARANTEE

Keep Model 208 ten days, if not completely satisfied return instrument for full refund — no explanation needed!

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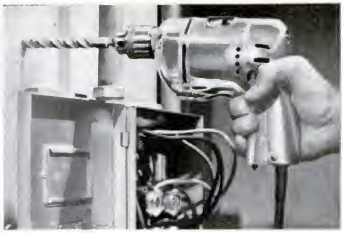
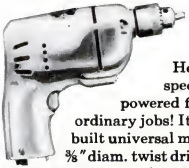


Now—for tougher drilling jobs NEW B&D 3/8" Utility Drill!



Only $38.95

Here's a new drill, specially geared and powered for tougher-than-ordinary jobs! Its powerful B&D-built universal motor drives up to 3/8" diam. twist drills, 3/4" wood bits, 1/2" masonry bits, and 1 1/4" Hole Saws. Perfect for advanced craftsmen and light installation and service work. See your B&D dealer today!

Get this Complete 3/8" Utility Drill Kit— only $64.95

Includes 3/8" Drill, 3 Hole Saws, 3 masonry bits, 3 wood augers and 8 twist drills in steel box with ample space for other items. Ideal for electricians, plumbers, carpenters, etc.

Bob Davis says: Send 25c in coin for my "Handy Tips" booklet, full of ideas and hints for home jobs. Write: Bob Davis, Home Service Dept. S -114, THE BLACK & DECKER MFG. CO., Towson 4, Maryland.

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The major material used is Homasote Type RD. Weatherproof and crackproof, this strong material saws and nails easier than wood, takes any paint or stain, lasts for years — indoors or out.

INDOORS—The unusual valance-bookcase, shown at the right, frames your windows — offers ample space for books, record albums, etc. — conceals the curtain rod. This is only one of 18 practical make-it-at-home suggestions to be found in the three new Homasote "idea" folders. Plans for chests and cabinets, details for a room in the attic, warmer, quieter floors, or a waterproof cellar — all are to be found in these folders. To secure all 3 booklets — a valuable addition to your make-it-at-home file — kindly include 10¢ for handling costs.

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My lumber dealer is.....

'55 Pontiac Is New All Over

[Continued from page 252]

is right back where it was on almost all automobiles before World War II—up under the windshield. The postwar anxiety to cut holes under the headlights and duct the exhaust-fouled air garnered there back through the hot engine compartment has run its course and history is repeating itself. (Just like yesteryear's outside spare tire, which, plucked from the luggage compartment, is once again riding modishly on the rear—only at extra cost.)

Tubeless tires are standard on the new Pontiac (see "How to Patch Tubeless Tires," p. 205).

A roof a full 2¾ inches lower gives the car a sleeker look. It also, a distinct plus, gives it a lower center of gravity to hug the turns. Yet the drive-shaft tunnel in the floor is no higher. To achieve that, Pontiac borrowed a leaf from Oldsmobile's book and canted the automatic transmission to the side. And, credit the designers, if the road clearance is any lower, it would have to be measured with a microscope.

Low Bridge for Tall Drivers

Lower cars necessarily sacrifice entrance room. Pontiac's cutout for the front door had to be shaved at the top by an inch and three-quarters. Six-foot drivers may growl.

But everybody will be pleased with the speedometer. A switch on the Buick barber-pole speedometer (PSM, Feb. '54, p. 146), it tells even a hyperopic driver instantaneously how many knots he is making when the motorcycle cop appears in his rear-vision mirror. He doesn't have to search for the needle on the dial. A disk, appropriately red, creeps across the dial as the accelerator goes down, to lodge against and sharply mark the figures. END

Candid Comment

Judging from some of the couples we see, bad accidents can also happen while hunting husbands.—*Wall Street Journal.*

NEW

3" Belt Sander

Now the EASY WAY to Sand Do-It-Yourself Jobs!

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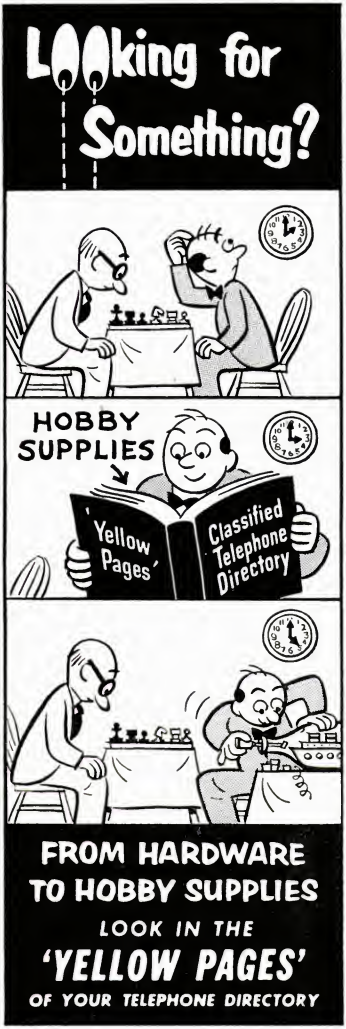

How Gadgets Save Lives

MANY dramatic operations now performed, such as operations on the heart and blood vessels, would not be possible without gadgets. One is the Potts ductus clamp. When it was first developed by Dr. Willis J. Potts of Chicago, professional surgical and medical journals were not interested in publishing a report about it because it was considered just a gadget. Now surgeons use it so much that the manufacturer has difficulty in supplying the demand.

Dr. Potts' clamp squeezes a blood vessel so that blood does not flow through it and spill out, yet without damaging delicate blood-vessel walls. The clamps have 20 very small and perfectly aligned teeth, so evenly placed that there is no undue pressure at any one point and therefore no injury. Another of Dr. Potts' inventions is a knife that opens after it has been inserted in a blood vessel.

Operating on a Shoestring

Shoestrings, white ones, actually are used by surgeons. They fit over the ends of an instrument called the Foss colon clamp to keep the clamping ends from slipping.

Some of the surgeon's stitching is now done by a stapler. It is known as the Von Petz suturing apparatus and is used for the first suture, or stitch, line in stomach dissections. Its jaws open and then close over the cut pieces that are to be stitched and then a special mechanism releases tiny metal staples to hold the edges together.

Surgeons can now button up hearts that have holes in them with nylon and Lucite buttons. Each of these buttons is made in halves, which fit together something like a snap hook. One half is pushed through the heart hole by a special instrument and then is pulled back so that teeth on the flat side of the button catch in the tissue of the heart's dividing wall. The other half button is then fastened to the first half.

A plastic ball for remedying a heart condition has been devised to help people with a heart valve that does not close. Some 200,000 persons are living today with this defect. The plastic ball is fastened into the aorta with nylon rings. When the blood is pumped into the big artery, the ball valve moves forward to let the blood through. But if the blood starts to rush back into the heart, the ball valve moves back and closes the opening.

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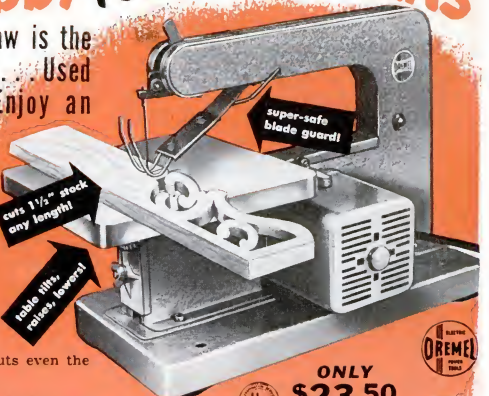

- The DREMEL is a real production tool, with a built-in ROTARY MOTOR. (Do not confuse with "vibrator" type jig saws.) The DREMEL is so powerful, it can cut 1½" wood, ¾" plywood, metals, plastics—*even 2 x 4's!*
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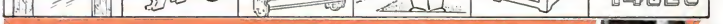

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Includes Model 1 Moto-Tool and 34 Accessories (steel cutters, grinding wheels, polishers, etc.) Packed in attractive steel case. Complete,

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Your best buy! Includes Model 2 Moto-Tool and 23 Accessories (high speed steel cutters, grinding wheels, polishers, etc.) Packed in sturdy steel case. Complete,

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DREMEL MANUFACTURING COMPANY Dept. 124-L RACINE, WIS.

Studebaker's New Surprise Package

[Continued from page 152]

The President's performance with the same block is, of course, enhanced by bigger valves, a bigger muffler and a four-barrel carburetor.

The same kind of surgery was done on the Commander engine for '55. With an actual reduction in piston displacement, from 233 to 224 cubic inches, the engine has been boosted from 127 to 140 horsepower.

As for the Champion, a Studebaker engineer who dotes on keeping track of his gas mileage, took a '55 job on a trip the other day. He didn't drive "about 500 miles." He drove, he told me, exactly 514 miles.

"I used 23.7 gallons of gasoline, regular grade," he said. "I had six people in the car, with their luggage. I drove half the distance at 55 to 65 miles an hour and half at 40 miles an hour, and I got 21.7 miles to the gallon."

The Champion engine, an L-head six, remains under-square. Its bore and stroke were three by four inches for 1954. The new engine's are three by 4⅜. The longer stroke provides more torque at low speeds.

Engine Block Is Sweet Sixteen

It's a tribute to this efficient little engine that the block is 16 years old. For those with a nostalgic bent, that first 78-horsepower Champion engine, vintage 1939, had a bore and a stroke of three by 3⅜ inches. Piston displacement was 164 cubic inches, compression ratio 6.5-to-1, horsepower output per cubic inch .475. The 101-hp. Champion for '55 has a displacement of 185 cubic inches, compression ratio of 7.5-to-1, and an output per cubic inch of .546. END

Slippery Article

Back from a walk, little Phyllis recounted, "We saw the funniest man. He was sitting on the sidewalk talking to a banana skin!"—*Ford Farming.*

New Easy Way to DRY CLEAN RUGS ...Earn Big Money!

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New wonder-way to dry clean rugs can start you earning *big money!* Full or part time. Homes, stores, offices are prospects. Amazing American ALM-13 machine with exclusive new Float-Action Whirling Brush does the work. Spread dry-cleaning material on rug . . . guide machine while brush whirls material into rug fibers. Out comes grease, grime, dirt! Pick up with vacuum. Can use rug immediately. Clean on location. Make rugs new-looking! Minimum investment. Write today for details.

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Oil Control Bearings

BEARING MANUFACTURERS TO THE AUTOMOTIVE INDUSTRY SINCE 1899

Silent Screams Carve Hardest Materials

[Continued from page 100]

School of Dental and Oral Surgery. With his collaboration, and the assistance of other leading dentists and doctors, Cavitron researchers undertook to develop the idea. First step was to adapt the machine tool's principle to a small hand tool, suitable for a dentist's use.

A succession of experimental models resulted. First drilling experiments were on extracted teeth. Later, a dog and a chimpanzee were given samples of painless dentistry.

Painless Drilling—in 50 Seconds

Then, last July, Dr. Oman and a colleague, Dr. Edmund Applebaum, announced the first use of ultrasonic drilling on human patients. Writing in the *New York State Dental Journal,* they told of filling cavities in four persons' teeth; in a typical case, the drilling took only 50 seconds. All four reported no pain, even in drilling highly sensitive teeth; and the resulting fillings proved satisfactory in every respect.

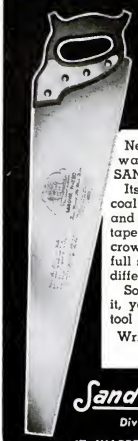
So new is ultrasonic dentistry that more investigation will precede its general acceptance. But studies to date show only one difference, in effect on the living inner part of a tooth, between conventional and ultrasonic drilling. The new way runs less risk of damaging tooth structure by heat, or by "gross" or tangible vibration.

The encouraging trials have led to a production model of the ultrasonic dental tool, now ready for what its sponsors call further "investigative" use. As this was written, the first 100 were being produced and distributed to selected dental schools, clinics, and clinical investigators in private practice. By early next year, 1,000 more should be available. END

Sign of the Times

Near its school, a small Ohio town posted this suggestion: "Use your eyes, save the pupils." —*Hudson Newsletter.*

Swedish Steel *Handsaws*



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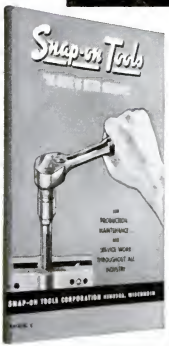

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Fred A. Short, service station proprietor of Los Angeles, Cal., says: *"If your oil filter's clogged, put in a Purolator Refill right away!"*

"Right here, in the book that came with your car,* it says—

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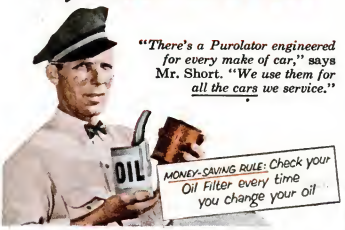

"There's a Purolator engineered for every make of car," says Mr. Short. *"We use them for all the cars we service."*

"Purolator," "Micronic" Reg. U.S. Pat. Off.
Purolator Products, Inc., Rahway, N. J.; Toronto, Canada.

Russians Cram to Beat Us in Science

[*Continued from page 107*]

cent feature anticipated the use of supersonic and high-frequency radiation for mining, driving vehicles and farm machinery, and the transmission of power.

Speculation is published regarding the use of subterranean heat, storage of energy, extension of human life to 200 years and the breeding of new animals and plants. Treatment of such subjects is serious and analytical. In the same way, stories on rockets to the moon touch only on the practical problems and limitations of space travel.

SF Advances "Struggle for Progress"

Recently the magazine announced a "science-fiction" contest. But readers were advised that their stories must "open before youth the forward march of bold creative thought and the struggle for progress."

But for all this shift to the Government's new line of "a better life," emphasis remains on knowledge as the key to boosting production. The magazine is only one weapon in the campaign for universal technical indoctrination.

A young Russian begins his study of science at the age of seven in a compulsory school. Reading lessons begin with elementary nature studies. At 10, the child spends 12 out of 27 hours weekly on science and related subjects. At 13, over half his time is given to them. This is standard throughout theU.S.S.R.

A universal 10-year course is now being introduced, and the transition is to be completed in all large towns and industrial centers by next year. The change-over is to be nationwide by 1960. Thus at 16 every Russian boy and girl soon will be sweating out six hours a week of math, five of physics, three of chemistry, and one each of astronomy and mechanical drawing.

Some 1½ million Russians were enrolled at universities and technical colleges last year. While the total is less than that in the U.S., the number of science students was substantially larger.

[Continued on page 264]

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Russians Cram to Beat Us in Science

[Continued from page 262]

Available figures indicate that 50 percent of Russia's entire student body, or 750,000, may be science majors. Comparable U.S. figures show a considerably smaller percentage. The number of American graduates has been dropping steadily, while Russia's has been rising.

The Soviet Government is devoting one-eighth of its budget, nominally $15 billion a year, to education. This goes into student grants, teachers' pay and new buildings. Millions were spent on the "Palace of Science" in Moscow, which opened last September.

This massive complex includes a 32-floor main building, 1,000 laboratories, 148 lecture halls and a 5,750-room dormitory. As everywhere else, each of the 17,000 students is training for a specific job, and he moves into one on graduating. There is no such thing as a liberal-arts course in Russia.

Workers Attend Factory Schools

The Soviet drive for skilled manpower doesn't stop with formal schooling. Nearly 8,000,000 workers are now attending spare-time factory schools. Specialized vocational schools are maintained for each branch of industry. About 1½ million young workers—a third of them girls—are taking two-year courses in machine tools, metallurgy, mining and 250 other trades. Beyond this, a whole network of clubs, libraries and adult-education courses reaches every corner of the country.

In a country where 30 years ago only one in four could read or write, the Russians are racing ahead to implement Stalin's call for "a whole new stratum of new engineers and technicians." Behind the Soviet's spectacular industrial advance a huge brain-cramming machine is working overtime. END

Bum Steer

Lady speaking to garage mechanic: "There must be *something* wrong with it. It keeps hitting things."—*Grumman Plane News.*

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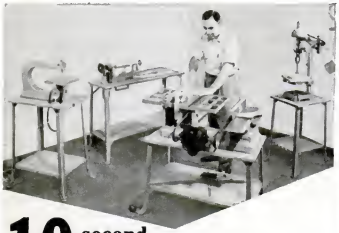

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How Hi-Fi Records Are Made

[*Continued from page 127*]

If the music is loud, the grooves must be spread as far apart as feasible, to prevent the stylus from cutting across the lands between them. If the music is soft, the grooves can be bunched together.

What the Recording Curve Is

The instant that a cutting stylus begins to record music from a master tape on a master disk, the "recording curve" is in operation.

This is a convenient way of referring to the extent to which technicians amplify the high frequencies (treble notes) and reduce, or attenuate, the volume of the low frequencies on the master tape in the process of transferring them to the master disk. It is done electronically and automatically by the cutter amplifier.

The reason it is done is that low frequencies at natural volume would cause the cutting stylus to fluctuate so violently that it would cut through from one groove to the next. High frequencies at natural volume would cause the stylus to cut such tiny squiggles in the grooves that they would tend to be lost among the granules in the lacquer surface of the disk. Consequently, the lows must be restricted and the highs boosted to prevent distortion when played back.

But if you were to play this master disk exactly as recorded, the lows would be anemic, the highs unbearably shrill. Consequently, hi-fi playback amplifiers are so constructed that they exactly reverse the recording curve, boosting the lows precisely as much as they were originally attenuated, attenuating the highs precisely as much as they were originally boosted. The net result is to make the music sound as nearly as possible as it did in the recording studio. END

Sound Prescription

Doctor: "Your husband must have rest and quiet. Here's a sleeping powder."

Wife: "When do I give it to him?"

Doctor: "Don't give it to him. Take it yourself."—*The Columbian Crew.*

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GIVE CEILINGS, walls new and dramatic beauty with Weldtex squares. Cover a 12′ x 15′ ceiling with 12″ or 16″ pre-cut squares for approximately $50*.

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Their Tallest Tales Are True

[*Continued from page 116*]

feeling useful. People turn to him to settle arguments. They may also ask him for forecasts. That isn't part of his job, but anyone really interested in the weather can make a good guess about what lies ahead. Furthermore, since he is dealing with his own neighborhood, he may sometimes do better than the official forecaster, who deals with a wide region.

One Saturday morning this last April, Arlington Race's wife wanted to drive 30 miles to do some shopping. She asked what the weather would be. Her husband checked the thermometer: it stood at 32. He looked at the sky: cloudy. The air felt damp. "Better not go," he advised. "We're going to have snow or sleet." Within a few hours, an unseasonable snow and ice storm had made roads all over the county almost impassable.

Amateurs Watch Nature's Signs

Here are some other tips amateur observers have found helpful:

Storms usually are accompanied by warmer weather. So if the temperature rises at a time when it normally falls—late afternoon and night—you can guess there will be rain or snow.

After a storm, the temperature usually drops. If it doesn't, clear weather won't last.

A ring around the moon signifies the approach of wet weather. A storm far to the west has thrown off thin, high-flying clouds and the ice crystals in these clouds, playing tricks with light, form the ring. The closer the storm, the bigger the ring.

On moist summer mornings when there is no high wind to prevent the air from heating, rising and condensing to form the clouds that grow into thunderheads, it is fairly safe to forecast a thunderstorm before the end of the day.

If there's dew or frost on the grass in the morning, look for a clear day. They don't form when the atmosphere is full of moisture and the sky is cloudy—conditions that precede a storm.

[*Continued on page 270*]

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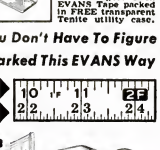

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Their Tallest Tales Are True

[Continued from page 268]

After several days of cloudy weather in winter, expect snow. It's likely to be a good, deep fall if the temperature holds steady somewhere below freezing, the wind increases, and the snow comes down at the rate of an inch or more an hour.

He Did It the Easy Way

Some years ago a cooperative observer in the Hudson River Valley had acquired such an excellent reputation as a forecaster that the chief meteorologist at the Albany station decided to investigate. He found his man living on a dirt road well out from town.

Without introducing himself, the meteorologist said he understood the old man forecast the weather so accurately he often beat the official Albany forecast.

"That's right," the farmer told him.

"How do you do it?"

"Just use things everybody knows," the farmer answered, "like dew in the morning and the kind of clouds."

"Nothing else?"

"Well, smoke, of course—in winter when it goes straight up, that means a storm. And chickens and birds oiling their feathers—that means storm, too."

"You're sure that's all?" pressed the man from Albany.

"Well, there is one thing more," the farmer admitted. "Some darn fool in Albany sends me a weather map and a forecast."

The visitor nodded, hopefully.

"And whatever he says," the farmer went on, "I say just the opposite."

Observers Stick to Their Jobs

About 20 of the cooperative observers have been taking records more than 50 years—and for each year of service, the Weather Bureau estimates, they have given the Government the equivalent of about 12 eight-hour days. Another 75 have served between 40 and 50 years.

The present dean of these volunteers is Henry Crisler, a newspaper publisher in

[Continued on page 272]

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Their Tallest Tales Are True

[Continued from page 270]

Port Gibson, Miss., who began taking records in 1891. The next year, George W. Richards, now 82 and a farmer at Maple Plain, Minn., opened a station.

John W. Barr, 86, a farmer near Vickery, Ohio, began making observations in 1893. Father Adelhelm Hess, a Benedictine monk, has been keeping the station at Conception, Mo., since 1894—along with being a professor of Latin and Greek and a country pastor.

Incidentally, Sam Pearson—characterized by the Bayonne, N.J., *Times* as "a man who has conducted a love affair with the weather for half a century"—has turned his hobby into a business. Upon his retirement recently from a New York bank, he opened an office as a consulting meteorologist and was elected a professional member of the American Meteorological Society.

No Help Wanted

Are there any openings for cooperative observers? Officially, the Weather Bureau says no; it doesn't want to be flooded with applications. Actually, cooperative observers do die, or move away, or even—a few—resign. Also, the network of stations shows some blank spots in thinly populated areas, mostly in the Rocky Mountain States and the South.

But you've got to get to those instruments every day at the same hours, not excepting Sundays. You are subject to telephone calls at any time from some darn fool with some fool question. And all you get out of it is the loan of a shelter that looks something like a beehive; plus two thermometers and a rain gauge—all in all worth maybe $100. Plus maybe a few dollars now and then as a witness in a court case. Plus the thanks of the darn fools who telephone you. Plus the knowledge that you are helping to build up—for the use of people today and a hundred years from today—a true picture of the American climate. END

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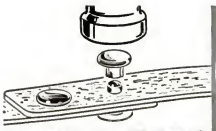

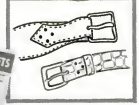

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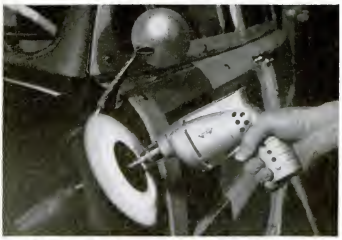

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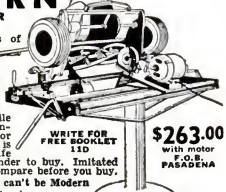

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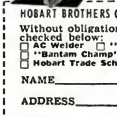

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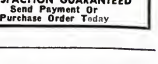

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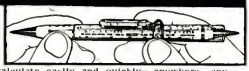

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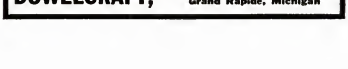

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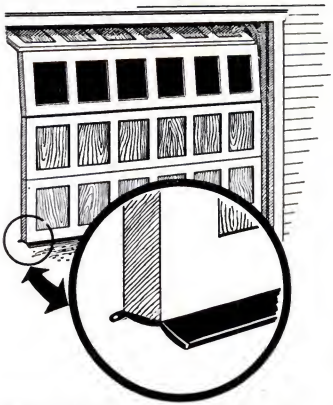

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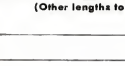

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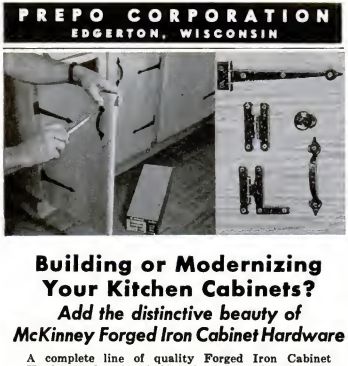

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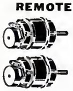

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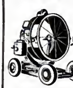

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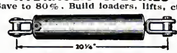

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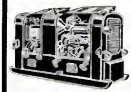

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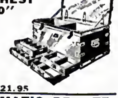

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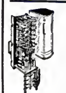

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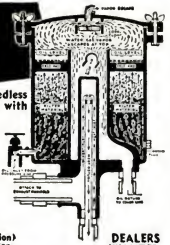

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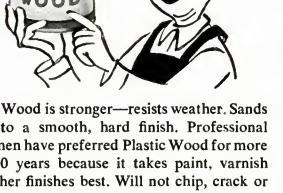

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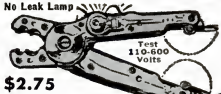

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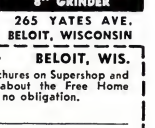
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How Much Did You Learn?

By Stanford E. Taylor and Helen Frackenpohl
Washington Square Reading Center, New York

Now you can sample how much you remember of the useful and interesting information packed into this issue of POPULAR SCIENCE MONTHLY. Answers to the questions are printed just below the quiz. After each answer is a page reference to the article on which the question was based.

1. ***A disadvantage of the new German "rubber-hub" wheels is that they***
   a. tend to turn eccentrically
   b. are unsafe at high speeds
   c. are not as beneficial on old cars

2. ***In ultrasonic machining, in one second the cutting tool delivers***
   a. 1,000 strokes
   b. 10,000 strokes
   c. 25,000 strokes

3. ***In 1980-90, Col. Bernt Balchen predicts, no flight will take longer than***
   a. one hour
   b. two hours
   c. three hours

4. ***Pontiac has improved its cooling system in '55 models by***
   a. reversing the flow of the water
   b. using high-velocity water pumps
   c. adopting a new honeycomb radiator

5. ***There is less surface noise in hi-fi recordings since the use of***
   a. antistatic plastic
   b. a heated cutting stylus
   c. reduced groove width

6. ***Amateur weather observers can spot a storm coming if the temperature***
   a. suddenly drops
   b. fluctuates
   c. unexpectedly rises

7. ***An unusual bonus with John R. Linders' house-warming heat pump is its***
   a. ability to cool the house, too
   b. very low consumption of electricity
   c. appetite for a wide variety of fuels

8. ***The big reason for the '55 Studebaker's flashy performance is its***
   a. high horsepower-to-weight ratio
   b. low piston travel per mile
   c. streamlined silhouette

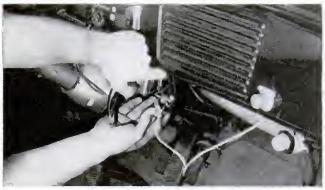
9. ***In Russia, the percentage of young people majoring in science is about***
   a. 40
   b. 50
   c. 60

10. ***The speed of an electric clock is controlled by a***
    a. mechanical governor
    b. synchronous motor
    c. electrically energized tuning fork

Answers: 1. c—p. 158; 2. c—p. 97; 3. b—p. 120; 4. a—p. 130; 5. b—p. 125; 6. c—p. 112; 7. a—p. 197; 8. a—p. 150; 9. b—p. 104; 10. b—p. 226.

NEXT MONTH . . .

From Autos to Mobiles



It's a big jump from changing an auto fuse to building a decorative, hanging mobile for your Christmas tree, but you'll be able to do both after reading December POPULAR SCIENCE MONTHLY.

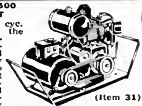
In one of many articles that will be devoted to automobiles in this fact-packed holiday issue, E. F. Lindsley will tell you how to avoid costly electrical breakdowns and what to do if trouble does occur.

Mobiles? They're art with a capital "A"—the latest thing in decoration for modern homes. But you don't have to be a longhair to like them. An expert will show you how to make one—in the form of a handsome Christmas tree.

This One
4E7T-BNH-NLTW

SAVE MIDDLEMAN PROFITS

GIANT 2000-2500 WATT PLANT



110-120 v. 60 cyc. AC. absolutely the best made — exclusive dynamically balanced armature; heavy windings develop up to 5000 watt overload for motor starting. Skid mounted — portable. Powered by an easy starting Briggs or Wisconsin 6 HP engine—complete with all accessories; engine easily disconnected for other uses. Big outlet box, voltmeter, no wiring necessary. Ample current for all purposes. Factory warranty. (Item 31) Wt. 210 lb.

(Item 31)

Reg. price $585. Special at..... **$299.50**

Same plant with electric self starter (Item 31a)......... **$359.50**

Generator only and control box.... **$169.50**

DUAL VOLTAGE 110-220 available on any of above models for $28.00 additional.

3000-3500 WATT PLANT (Item 198) 110-220 v. 60 cyc. AC Belt Drive. Wis. engine **Push Button Start.** Wt. 370 lbs. Heavy duty **$439.50**

GENERATOR ONLY for belt drive.. **$239.50**

BUY at factory prices direct from MASTER MECHANIC

600-700 WATTS
PUSH BUTTON START

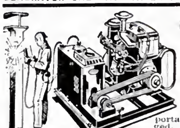
(Item 24)

115 v. 60 cyc. AC Powered by a rugged 2 HP easy starting Briggs engine. No wiring necessary; just plug in and operate. Plenty of current for any oil burner, freezer, brooder, emergency lights, etc. which require up to 700 watts. Ideal for television and radios. Complete with Voltmeter and built-in winding to charge 6 v. auto batteries. (Item 24.) Wt. 75 lbs. Easily fits in car trunk. Be prepared if storm knocks out power lines. Reg. $275 value..... **$143.50**

1000-1200 Watt Plant (Item 45) same as Item 24 but larger generator and engine with 50% greater output....... **$199.50**

LITTLE GIANT—350 WATT (Item 273) 115 v. DC 1½ hp. Briggs engine. Perfect for lights, radios, chain saws and power tools. Wt. 65 lbs........... **$99.75**

MASTER DC ARC WELDERS



(Item 280)

Now! a portable, rugged, industrial type welder with terrific performance, yet at a price hundreds of dollars less than you'd expect. Senior model made for years of trouble-free, continuous service. High capacity DC welding unit enables you to tackle any job with confidence—easily welds anything up to 2" plate using from 1/16" to ¼" rods. Built-in stabilizer and cooling syutem makes arc easy to strike and hold. Dual control rheostat provides low heat soldering, brazing and welding from 30 to 300 amps. Complete with instructions, guarantee and triple V-belt or flat pulley. You can pay more, but you can't buy a better welder.

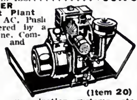
WELDER ONLY — DUAL CONTROL MODEL. Same as above, but drive with your tractor, jeep or gas engine of 14 HP or more. (Item 38a.) Wt. 110 lbs. $450 value.......... **$119.50**

WELDER ONLY—STANDARD MODEL. Same as above but with single rheostat for heavy metal welding only. (Item 38.) Wt. 110 lbs. $400 value. Special.. **$99.75**

COMPLETE POWER MASTER (Illustrated above) powered by a 14 hp., air cooled Wisconsin engine. Wt. 480 lbs. (Item 280) Compares with welder costing $1200. Special for November only...... **$399.50**

WELDING KIT, Two 10 ft. leads, welding helmet, electrode holder, ground clamp. Sold only with welder...... **$10.50**

PORTO-POWER
1500-1750 Watt Plant

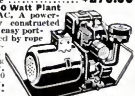


115/130 v. 60 cyr. AC. Push button start. Powered by a 4.5 HP Briggs engine. Combinrs compactness and rasy portability with higher output for handling heavier starting loads. Ideal for operating oil burners, sump pumps, freezers, television, lights, communiration systems, etc. Perfect for rontractor's power tools. (Item 20). Wt. 146 lbs.

(Item 20)

Factory Special Price **$279.50**

MASTER-LITE 2500 Watt Plant



110/120 v. 60 ryc. AC. A powerful plant, ruggedly constructed and yet designed for easy portability. Can be storted by rope or built-in 12 v. electrie push button starter. Built-in winding to charge bsitery. Powered by a big 5.10 HP Briggs enginr, complete with oil arressories. Includes rontrol box, voltmeter, and handy plug-in power rereptarle. An idral plant for permanent or stand-by servire. Wt. 225 lb. Reg. prire $645.00

(Item 21)

(Item 21) Factory Prire **$329.50**

3500 Watt Plant Push Button Start (Item 23) 115 v. 60 cyc. AC. Similar to above, but larger and 33% more capacity. Wt. 270 lbs. Reg. $760. Factory Price.............. **$379.50**

We make fully automatic controls to operate any of the above light plants. Write for details. We make all sizes up to 25,000 Watts.

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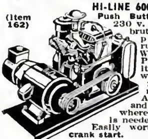
HI-LINE 6000 WATT PLANT



(Item 162)

Push Button Start 115-230 v. 60 cyc. A.C. A brute of a power plant with a rugged 14 hp. Wisconsin engine. Plenty of electricity for ranges, water heaters, freezers, pumps, machinery, etc. Affords both 110 and 220 volts. Ideal where heavy current is needed. Wt. 590 lbs. Easily worth $995. **With crank start.** Factory price **$585.50**

Same plant, but with **self-starter, $645.00**

Generator and control box only, belt driven. Use your own engine or tractor. Wt. 240 lbs. (Item 163) Factory price **$345.00**

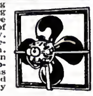
JET FLOW BLOWER

Tremendous air movement (1800 CFM) and quiet operation make this double inlet 10" turbine blower unbeatable for heating, cooling, drying and air conditioning. Ideal for attic or born ventilation, converting gravity heating to forced air; spray booth exhausts, etc. Operates with any ¼, ⅓ or ½ HP motor. Oversized, long life bearings. Includes variable speed motor pulley and belt. Dimensions 19" hi x 18" x 16½". Outlet opening 13" x 11⅜". Wt. 45 lbs. Item 245. Reg. $54.50. Factory Special............... **$27.50**

HEAVY DUTY ¼ HP motor for above **$16.95**

12" TURBINE BLOWER Similar to above, but larger with 2400 CFM capacity. Wt. 65 lbs. (Item 245a) Reg. $70.00. Factory Spec. **$34.50**

CONDITIONAIRE BARN FANS



Save big money installing your own barn ventilating fan. Efficient propellor type blade moves huge volume of air quietly and effortlessly. Heavy welded frame — pre-drilled for easy installation. Just cut opening and bolt in place. **Continuous duty motors.** Ideal for keeping barns and chicken houses dry and ventilated. Control manually or with thermostat.

Blade	Opening	CFM	Wt.	Item	
16"	18¼"	2925	19 lb.	365a	$27.95
18"	19¼"	3600	27 lb.	365b	$31.95
20"	21¼"	4100	30 lb.	365c	$39.95

THERMOSTATS: BARN type (range 40°-60°). Wt. 2 lbs. **$6.95.**

HEATING & VENTILATING FAN

(Item 10) Easily installed in furnace pipes. Forces even heat to all rooms. Over range removes kitchen smoke and odors. Powerful, continuous duty motor, 110-120v. AC. Mount in wall or ceiling to ventilate any area. Quiet, super-efficient fan moves huge volume of air. (400 to 600 CFM).

8" Fan, wt. 5 lb................... **$6.85**
9" Fan, wt. 6 lb................... **$7.85**
10" Fan, wt. 7 lb.................. **$8.85**
12" Fan, wt. 8 lb.................. **$9.85**

HEAVY DUTY FAN. Semi-enclosed motor, suitable for spray booths, restaurant exhausts, poultry houses, etc. 10" Fan, wt. 8 lbs. (Item 10E).................. **$11.95**

12" Fan. wt. 10 lbs. (Item 10D).... **$12.95**

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Very flexible and tough; Neoprene #16-2 conductor cord, ideal for lawn mowers, hedge trimmers and power tools. U.L. approved. Complete with heavy rubber plug and outlet. 40 ft. cord (Item 17a) Wt. 2½ lbs. regularly $4.95—SPECIAL.. **$2.95**

100 ft. combination (2-40 ft. and 1-20 ft.) Item 17N. factory price.... **$6.45**

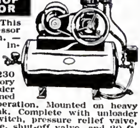
NEOPRENE CABLE #14-2 (Item 185) Heavy duty, very flexible, 20 year quality. Wt. 9 lbs. 100 ft. Complete with rubber plug and outlet. *A terrific buy at only*..... **$8.95**

NO. 12-2 POWER CABLE. Very flexible rubber covered, special outside shield for grounding power tools, etc. 50 ft. (Item 199) wt. 8 lbs. **$6.95.** 100 ft. (Item 200)........ **$12.95**

No. 10-2 POWER CABLE. Heavy duty, very flexible, rubber covered, 50 ft. with male plug and terminals. (Item 592a).......... **$10.45**

50 ft. without fittings (Item 592).. **$9.95**

MASTER SHOP COMPRESSOR



Big and rugged. This stationary compressor provides 8 c.f.m. — plenty of air for industrial uses, powered by heavy duty repulsion induction ¾ HP, 115/230 v. motor. Factory type twin cylinder compressor designed for continuous operation. Mounted on heavy 22 gal. steel tank. Complete with unloader type automatic switch, pressure relief valve, check valve, gauge, shut-off valve, and 20 ft. heavy duty air hose. (Item 209h) Regular retail $319.50. Factory price **$174.50**

52 pc. SOCKET SET

Highest quality, guaranteed non-breakable sockets made by Husky. Beautifully matched chrome thin wall alloy absolutely the best. Contains a complete set of 28 sockets in ½" drive, ⅜" drive and ¼" drive, plus all necessary extensions, handles, speeders, reversible ratchets, etc.; all uncond. guaranteed against breakage. A beautiful set of tools that will handle any job; in a **big** doghouse steel box. Wt. 17 lbs. (Item 205) List price $62.90. Factory special.. **$27.95**

44 Pc. SOCKET SET

(Item 596) Same unconditionally guaranteed, non-breakable sockets as above. Complete range of 21 sockets from ¼" thru 7/16" (¼" drive) & 7/16" thru 1-1/16" (½" drive). Two extensions, reversible ½" ratchet, 3 drift punches, sliding "T" head, all angle coupling, ½" speeder, ¼" breakover, 5 pc. high chrome alloy combination wrench set and 8 pc. offset wrench set in **big** doghouse tool box with ample room for other tools. Reg. $49.50. Wt. 16 lb......... **$21.95**

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Completely self-priming! No foot valve required. Tremendous raparity—100 gal. per min. ! . . Special impeller enables pump to handle muddy or sandy water. Simple to operate—simply start engine and watch the water go. Powered by a rugged, easy-starting 2 HP Briggs engine. Prelubrirated sealed bearings for years of heavy low-cost service. **Big 1½" Model.** Item 502. Wt. 70 lbs. Factory prire.... **$134.50**

2" Model (150 gal. per min.) with 2½ HP engine. Item 502a. 90 lbs. Fact. Spec. **$154.50**

JET STEAM MASTER

Now, a new super-efficient portable steam generator that provides live steam at 100 lbs. pressure in 60 seconds from a cold start! The first quality steam blaster ever offered at this low price. Instantly cleans, sticky grease, dirt, rust, old paint, etc. off motors—farm implements and road machinery. Pays for itself in a few weeks. Sterilizes as it cleans — milk equipment, etc. Fully automatic—oil fired with built-in water circulating pump. Draws water from faucet or bucket. Simple and safe: anyone can use it—built-in safety valve. New triple efficiency jet steam gun automatically mixes in soap or detergent if desired. Wt. 250 lbs. Item 463. Special Factory Price..... **$298.00**

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A tremendously powerful hydraulic press, capable of exerting 18,000 lbs. pressure. Pays for itself many times over—straightening bent connecting rods, king pins, crankshafts, axles, link pins and bars — or pushing out frozen bearings and bushings. Developed pressure under precise control and visible at all times on accurate gauge. Complete with both large and small anvils and jigs to straighten any kind of curve or bend. (Item 464) Wt. 110 lb. Actual list price $365. Our special close-out price.... **$69.50**

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Base Price $3190

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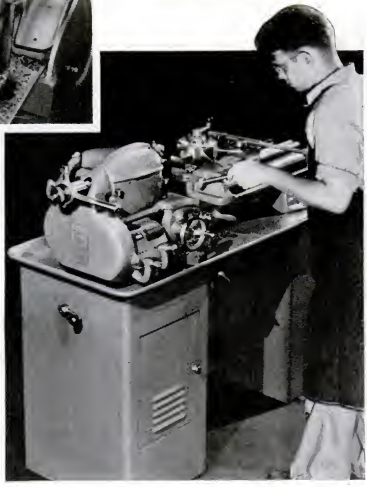

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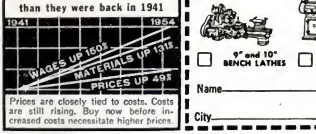

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